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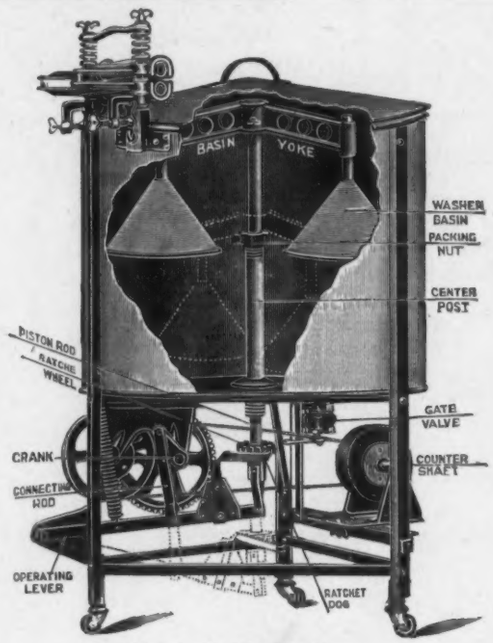

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PACIFIC COAST ELECTRO-CHEMICAL POSSIBILITIES

BY ROMAINE W. MYERS.

(After a brief summary of electro-chemical installations on the Pacific Coast, including a detailed description of the plant of the Electro-Alkaline Co., the author discusses future possibilities especially with regard to the fixation of atmospheric nitrogen. This paper was written for presentation before the San Francisco Section of the American Institute of Electrical Engineers, March 26, 1915. Mr. Myers is a consulting engineer at Oakland, Cal.—The Editor.)

The rapid and enormous development within the past twenty years in the manufacture of many of the most valuable chemical products known to mankind by electrical methods has so far caused but little interest on the Pacific Coast. In fact this holds true to a great extent for the whole of the Western Hemisphere; where on the other hand they have been flourishing to an extraordinary extent in those European countries whose topography Nature has endowed with large water power resources, as in Norway, Sweden, Gemany, Italy, France and Switzerland. In the United States mammoth electro-chemical plants are in operation at Niagara Falls. At Rumford, Maine, and in other centers many smaller plants are also engaged in the production of electro-chemicals. The Southern Power Company in North Carolina is now engaged in building a large plant for the electrolytic production of aluminum, and a small plant at Nitrolee, South Carolina, is in operation producing nitric acid from the air by the Pauling system.

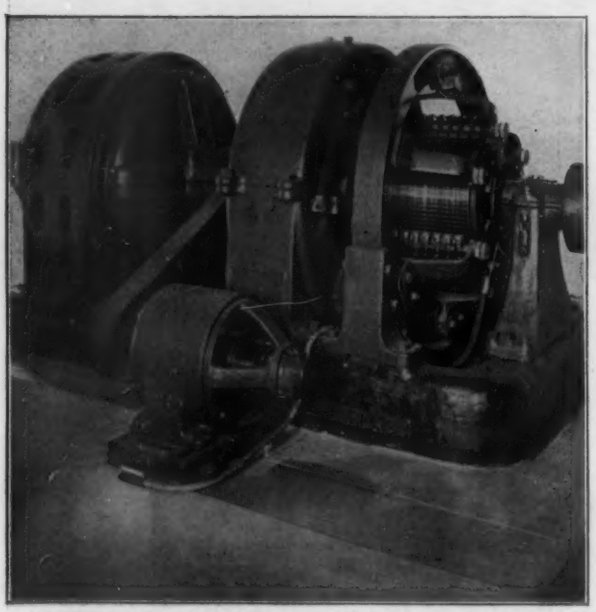
Long Lake, Alaska, Part of the Speel River Project for Developing 100,000 h.p. at an estimated cost of less than $6 per kw.-yr.

On the Pacific Coast up to the present, notwithstanding the enormous power development that has taken place in the past fifteen years, the advance in the electro-chemical lines has been very meager. Several small plants have been installed for producing hydrogen and oxygen by means of electrolysis from water. Some efforts have been made in the electro-chemical treatment of ores, but with small success. At Heroult, Shasta county, Cal., the Noble Electric Steel Company made an heroic effort through the extremely cheap power at their command, to reduce iron ores from its own mine in the electric furnace. But after spending much money and employing high talent in developing the various technical features involved, have finally had to abandon the work.

There recently has been installed a Stassano furnace at Long Beach, Cal., for converting steel and iron scrap into homegenous metal. Also a three ton Girod electric furnace is in operation at Seattle, Wash. In the conversion of steel and iron scrap into steel products, it requires 900 to 600 kw.-hr. per ton, the operation taking on an average four hours. This load would fit in the gap of the off peak load and could be probably taken advantage of by some of the hydro-electric power companies on the coast.

Electro-Alkaline Plant.

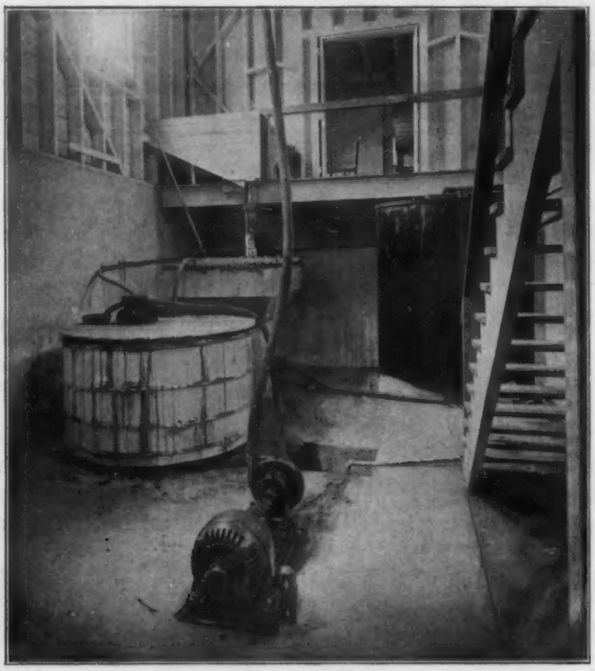
A year ago a company was organized to build an electrolytic-chlorine plant for the manufacture of bleach liquor for use in laundries and as a disinfectant. There were placed in operation 12 Whiting cells using a mercury cathode. This plant was installed under my supervision and has been in operation since July, 1914.



Motor Generator Set in Electro-Alkaline Plant.

This plant, owned by the Electro-Alkaline Company, is on the lines of the Southern Pacific at High street, in Oakland. The building is of frame construction having 7400 square feet of floor space. Power is received from the Great Western Power Company. The transformers are placed outside the building, the current entering being a.c. 440 volts, three-phase, 60 cycle. This is delivered to a 300 h.p., three-phase induction motor connected to a 200 kw., 125 volt d.c. shunt wound generator separately excited. The generator at the present time is operated at 58 volts and 1350 amperes.

This current is distributed to the 12 Whiting cells, the positive being connected to the graphite anodes,



Pump-pit, Showing Concentrator.

flows through the brine, to the mercury, which is electrically in contact with the cathode bus bar. The current in passing through the electrolyte, decomposes the brine, chlorine being given off at the anode, rising upwards, the sodium separating on the surface of the mercury and amalgamating therewith.

When this action has continued about two minutes, a valve releases the sodium amalgam from the electrolytic compartment, allowing it to flow to the oxidizing compartment. As soon as the sodium amalgam is free from the cell chamber, the valve closes and regenerated mercury is pumped back, thus again becoming a new cathode for the period of two minutes. In the meantime, the sodium amalgam in the oxidizing compartment flows by gravity over graphite plates, and in so doing is freed from the sodium it contained, pure mercury only thus reaching the pump-pit.

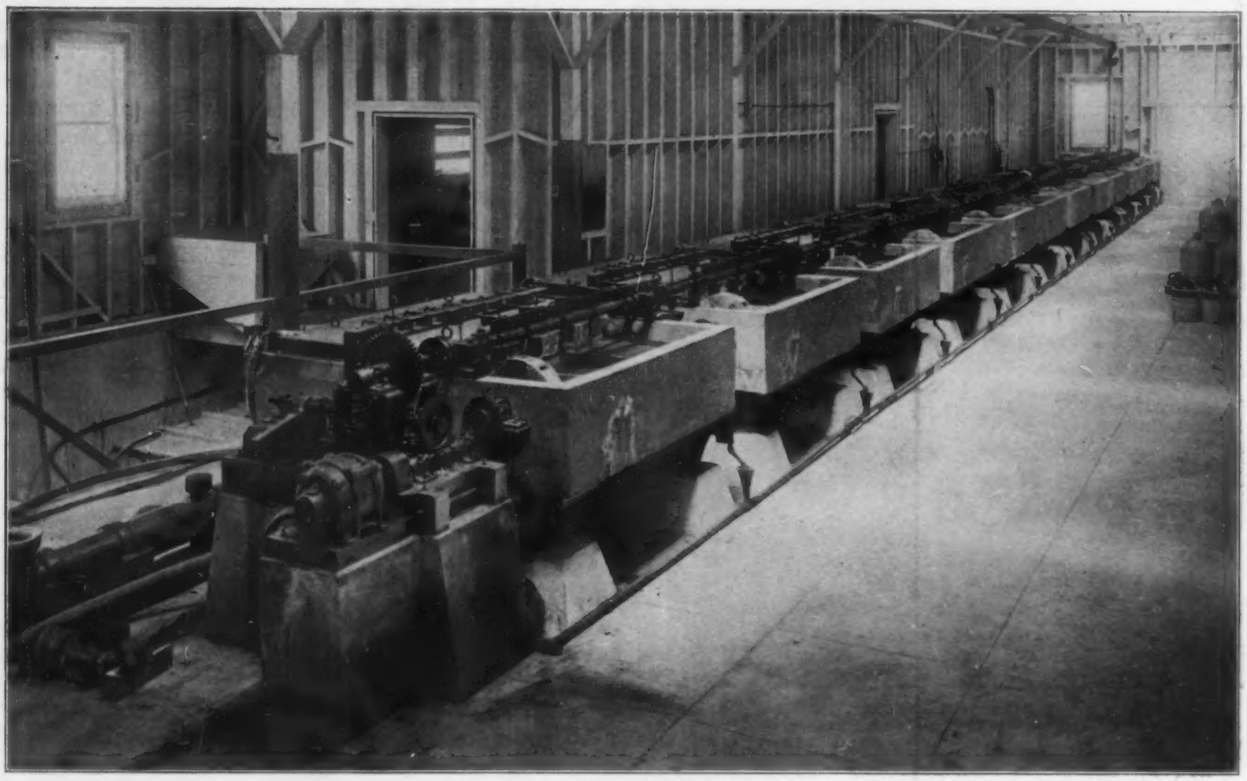
The graphite plates are so designed as to form a number of channels through which the mercury flows. The sides of these channels extend upwards into the caustic solution, and form, with the amalgam, a galvanic battery; the amalgam, thereby being decomposed, also liberates its equivalent in hydrogen. The galvanic action proceeds at a very vigorous rate until all the sodium in the amalgam is oxidized, when it automatically stops, sodium-free mercury being delivered to the mercury pump to be returned to the decomposing electrolytic compartment, thus concluding the cycle. Pure caustic of almost any strength may be produced by regulating the amount of water in the oxidizing chamber.

The caustic made at the Electro-Alkaline Company's works is of 25 per cent strength. This is pumped into absorption jars. Into this solution the chlorine is absorbed by the aid of a vacuum pump, a slight alkalinity remaining. The liquid produced is a 20 per cent hypochlorite of sodium solution and is the product furnished to laundries.

The average efficiencies and readings have been as follows:

Current efficiency of cells	95 %
Energy efficiency of cells	46.5%
Load Factor	97 %
Efficiency of conversion a.c to d.c.	78.3%
Power factor	83 %
Chlorine in lbs. per kw.-hr. (a.c)	.462%

The efficiency of conversion a.c. to d.c. is necessarily low due to the motor-generator running at half load.



Cell-room of Electro-Alkaline Co.

This plant, as yet, is not operating 24 hours daily, but from continuous runs of 48 hours or more, the load factor has averaged 97 per cent. There is no reason why the load factor will not average over 90 per cent when operating the plant continuously. It is possible to obtain this high load factor in many of the electro-chemical processes; therefore, it is needless to state that a load of this character should prove attractive to the power companies.

The plant has been so constructed as to allow of an indefinite extension in the production of both chlorine and caustic, knowing that the commercial development in these lines warrants further installation.

Excepting the iron industry, in which a possible 10,000 to 20,000 kilowatts might have been used under successful conditions in electric furnace smelting, the various electro-chemical installations on the Pacific Coast quoted in this paper are consumers of electric power in small units only. While some of these are quite remunerative to the owner or company of medium investment, they do not interest the large investor or big power company having at their disposal 10,000 to 50,000 kw.

The feature of interest to the Pacific Coast is the tremendous off peak power for which no profitable use has been developed. This paper is presented to the Institute today for the purpose of taking up such suggestions as will render available this great surplus of power, at present without commercial value.

As the large power companies have installed their plants so that in most cases it will be a comparatively small matter for them to increase their capacity to over four times their present production, the question that arises is could a market be developed for this tremendous amount of available power? If the same amount of energy and money be used in the building of lines and substations for irrigation, mines, and other purposes, as has been expended in the development of new territory of power companies, it is possible that such power could be utilized to profitable advantage.

With the great interest shown in the various novel applications of electricity to the production of specific chemical compounds, the question that mainly interests the investor or company of large means is, as is well known, not the inventive features involved, but strictly the dollars and cents question.

Nitrogenous Fertilizer Possibilities.

Of prime importance today from both the chemist's and farmer's standpoint is the food question. With the ever-increasing population and continued

greater demands for the products of the soil, the food for plants in the form of nitrogen, phosphate and potash, aside from those soil minerals that are easily available, is a crucial one. The U. S. phosphate rock deposits, particularly those undeveloped in the West, are probably ample for many centuries to come. Potassium salts, of which an unlimited supply is available in the German Strassfurt deposits, are enough for the world's consumption for many thousand years. These are temporarily cut off by the European war. Many chemists in the United States are endeavoring to replace them by the unlimited potash-feldspar, kelp and other sources, which to a certain extent, assure the necessary supply of this fertilizer chemical for the agricultural purposes.

As to the nitrogen products required for the soil, the situation is somewhat different. It is true that in the various packing house products, fishoffal and sewage from the cities, ammonium sulphate from

Absorption System.

coke ovens and gas works, a limited supply of fixed nitrogen products is being obtained. It is estimated that the great sodium nitrate or Chilian nitre deposits will last, at the present rate of consumption, from 20 of 50 years. This must be carefully husbanded, as its enormous consumption in the manufacture of explosives and other chemical products will exhaust the ever increasing uses of this chemical and leave the world bare, unless augmented from the unlimited supply in nature, that is, the air.

Under the present conditions of civilization the various dilute sources of fixed nitrogen products are not regained, but are entirely lost in the cycle of human consumption.

As the nitrogen of the air in its original state is only slightly available to plant life and cannot be relied on to any extent in the general scheme of agriculture, the nitrogen must first be obtained in a "fixed" state to be of any value as a fertilizer for food plants. Modern intensive farming methods require the richest "fixed" nitrogen products. In both ammonium sulphate and artificial nitrate directly obtainable from the air through electrical means, true hygienic fertilizers are available. Being produced by high temperature methods and from inorganic sources, they are absolutely free from dangerous disease producing germs, which is not true of animal offal and sewage.

The development of nitrogen-fixation from the air by electric furnace and flame methods in the past few years has been so rapid as to make these systems practically the most important ones for some time to come.

It is needless to state that air is composed of 80 per cent by volume of nitrogen, the remainder being oxygen. This nitrogen from both the chemist's and farmer's standpoint is not "fixed"; that is, it has practically no plant food value. To "fix" this nitrogen, it must be chained to either lime or clay combinations or burned in the electric flame at a very high temperature, and, as will be seen, it requires adept chemical and electrical effort. The value of this "fixed" nitrogen commercially, in the form of either of ammonia, nitrate, or amide, is 15 to 20 cents per pound, and from an industrial standpoint sifts itself down to a question of kilowatts per pound of nitrogen necessary for "fixation," the lime and clay minerals involved and general engineering features to handle the plant on a large scale. From data of various plants, 1 kw.-hr. "fixes," by the furnace methods, from 50 to 75 grams. This is equivalent to 975 to 1500 lb. of "fixed" nitrogen per kw. year, thus having a power value of $146.00 to $225.00 per kw. year. From this is to be deducted the cost of the raw materials, labor, engineering, transportation and marketing, together with other general expenses.

In the electric flame methods, the nitrogen fixation per kw.-hr. is only one-fifth of that obtained by the furnace methods, showing an estimated 3 per cent efficiency. While this system has proved remunerative in a number of European plants working on cheap power, its efficiency is such that unless employed in a combination plant, an installation of such a system would only be advisable in instances where off peak power could be applied; as its elasticity of operation makes possible the adoption of this latter method. That is, the power can be switched off or on without seriously interfering with the routine of the process.

The object of employing electrical energy in the fixation of nitrogen by electric furnace methods is not that there is some intricate or "wheel within wheel" feature whereby the molecular union of nitrogen in its suitable compounds is attained, but purely to overcome oxidizing conditions, such as would be caused in employing oil or solid fuel in ordinary retort heating. While some chemist may yet discover a means of nitrogen fixation from the air without first separating the oxygen, it is now necessary to entirely separate the oxygen from the nitrogen and have the nitrogen as pure as possible in order to obtain the reaction desired.

This, in practice, is accomplished by mechanical means or refrigeration, as in the Linde or Claudet systems or "liquid air process." Also by burning out the oxygen by means of carbon (generator gas) and cop-

per; further efforts are being made by inventors to simplify the system of nitrogen separation, as this is a feature of considerable expense in the enormous initial investment demanded as well as cost of plant operation.

Leaving out the mysticism from nitrogen fixation, it all sifts down to the process of mixing burnt lime with ground coal or coke and heating electrically in an air-tight roasting furnace to a temperature of from 1500 to 2500 deg. F., passing pure or impure nitrogen gas over the same, as in ore roasting, so that the nitrogen is absorbed, or combines, with the carbon and calcium of the lime, forming a product, which, when boiled with super-heated steam, gives off its "fixed" nitrogen in the form of ammonia gas. This is then united with sulphuric acid to form ammonium sulphate. The lime-nitrogen compound, without its ammonia first boiling off, may also be directly applied as a fertilizer.

Other furnace processes of nitrogen fixation are based on the employment of alumina in the form of bauxite. Magnesite, dolomite, clay or feldspar are also proposed. In fact all the processes developed, to date, are based upon the same principle of mixing a carbon material with an alkaline earth, heating to a bright red heat in an oxygen-free atmosphere and subjecting to nitrogen gas. From an engineering or economic standpoint, it resolves itself to bring the cost of the initial investment down and to have small labor and overhead costs in production. The aim in developing newer ideas in nitrogen fixation is to work along lines of least expenditure of energy and investment.

The raw materials required exist in enormous quantities on the Pacific Coast, and with the cheap power, efficient labor, and good engineering skill at hand, there is no reason why this industry should not be built up to an unlimited extent. Unlike many of the electro-chemical products produced today, as calcium carbide, aluminum, electrolytic copper, and chlorine products, no monopoly as yet controls the nitrogen products situation from the commercial standpoint; the field still being entirely open. We need not state that the Pacific Coast conditions with reference to the Eastern situation are such that many industries that are constantly proposed to be established here fail for the lack of sufficient consumption, due to our scant population, and that the eastern manufacturer can always dump his surplus here at a lower cost than his products can be produced locally. This, however, cannot be the case with any of the nitrogen products; as the markets are wide open and a famine is to be expected rather than as otherwise already noted. Therefore, no mistake can possibly be made by the power companies of the West in giving their undivided attention toward encouraging this large and profitable field.

Statistics of the U. S. Census reports (1910) and "Mineral Industry" (1912) show the following U. S. consumption of commercial nitrogen products:

From U. S. Census report 1910. (Year of 1909):

Fertilizers: Ammonium sulphate, 65,592 tons; value $3,732,112, or about 200 tons per day, equivalent to 50 tons anhydrous ammonia.

Sodium nitrate: 89,846 tons; value $3,916,320, or 300 tons daily, equal to 210 tons nitric acid daily.

Explosives:

Sodium Nitrate or (Chile saltpeter) 188,889 tons; value $7,892,336.

Potassium Saltpeter: 6032 tons; value $602,500.

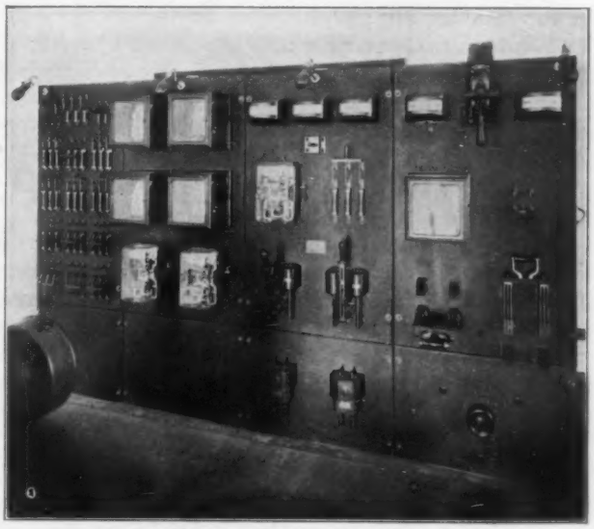
Nitric Acid: 31,500 tons; value $3,150,000.

Ammonium Nitrate: 5,500 tons; value $660,000.

Total value of nitrogen products consumed for year of 1909 in United States, $16,221,156.

From Mineral Industry 1912, imported in U. S. 1811.

Chilian Nitrate: 481,786 tons; value $15,427,904.



Switchboard in Electro-Alkaline Plant.

Ammonium Sulphate: U. S. production 165,000 tons, of which 130,000 tons were produced from coke ovens and 35,000 tons from gas works. The U. S. consumption was 232,000 tons, necessitating an importation of 67,000 tons.

United States Imports, 1914. (Foreign imports only):

Ammonium Sulhphate: 74,121 tons; value $4,475,603.

Sodium Nitrate: 53,803 tons; value $2,343,123. Total value $19,704,274.

Pacific Coast Imports, 1913. (Foreign imports only):

Ammonium Sulphate: 11,462 tons; value $716,824.

Sodium Nitrate: 53,803 tons; value $.,343,123. Total value $3,059,947.

Japan in 1911 and 1912 imported 75,000 and 93,-999 metric tons, respectively, of ammonium sulphate. This is equivalent to 80 tons anhydrous ammonia per day, or 60 tons fixed nitrogen, showing that the Japanese have begun to recognize the value of inorganic nitrogen products in agriculture, and should this be extended to China in equal ratio to its population, it is probable that 100,000 to 150,000 kw. could profitably be consumed in nitrogen fixation on the Pacific Coast for both the United States and Oriental markets. This would be equivalent to about 250,000 to 325,000 tons of ammonium sulphate, having a value of $15,000,000 to $22,500,000 per year.

Recently methods have been developed for producing nitric acid from ammonia gas by mixing the ammonia vapor with air and passing over a platinum contact mass. The price of nitric acid is five cents per lb. One pound of ammonia will, in practice, produce 3½ lb. of nitric acid at low cost. This promises to replace the nitric acid systems that have been

developed by burning the nitrogen plus the oxygen from the air as previously noted, the efficiency of which is only 3 per cent.

Assuming, as an example, a plant that would consume 20,000 kw., and on the basis that a kw. year will produce 1200 lb. of "fixed" nitrogen, equivalent to 1400 lb. of anhydrous ammonia, or 5600 lb. ammonium sulphate, 20,000 kw. years will therefore produce 28,000,000 lb. anhydrous ammonia, or 112,000,000 lb. ammonium sulphate, or 56,000 tons, which, at $60.00 per ton, is equivalent to $3,360,000. This per kw. year is $168.00 gross, which leaves a large margin for establishing the industry on this Coast.

While having particularly dwelt on the importance of interesting the hydroelectric power companies in the opportunities of profitably transforming kilowatts into nitrogen products, the question may be aptly asked, what more can be done with our surplus power in the way of manufacturing chemical products on the Pacific Coast by means of electricity?

While I do not pretend to say that no other electro-chemical opportunities are open, none of them offer either the immediate technical and commercial success or the field that the nitrogen products do.

Here, however, is a list of chemical products that can be produced electrically. These offer various opportunities in the utilization of electric power on the Pacific Coast:

1. Electrolytic refining of copper.
2. Ferro-Silicon.
3. Chlorate of Potash.
4. Caustic Soda, Chlorine products.
5. Tungsten steels.
6. Calcium Carbide.
7. Hydrogen Peroxide.
8. Sodium Perborate.
9. Zinc and copper.
10. Antimony.
11. Aluminum.
12. Phosphorus.
13. Cyanides.
14. Fusion of clay for refractory ware.
15. Graphite.
16. Carborundum.
17. Chlorine for leaching copper from sulphide copper ores without roasting.
18. Detining scrap.
19. Arsenates.
20. Gas and gasoline.

I desire to acknowledge my indebtedness to Mr. D. Mosher, consulting chemist, for valuable assistance in the preparation of the above paper.

The telephone as a truancy cure is being regularly used by the Los Angeles public schools. Each school has a telephone switchboard and a list of the parents and telephone number of each pupil, so that the reason for absence from school is quickly ascertained. The exchange is operated in short shifts by the pupils as a part of their regular school work.

The size of a motor is determined not by its horsepower, but by its torque. The motor is designed so that it will radiate the heat generated in its windings without undue rise of temperature. The amount of heat dissipated is proportional to the radiating surface times the difference in temperature between the machine and the surrounding air. The torque developed by a motor is proportional to the current times the flux. The flux density which can be used is fixed quite definitely, so that with a given size of machine, using the best materials, the flux is practically determined. This makes the torque depend on the current and consequently on the size of the machine. The power output is proportional to the torque times the speed, so the size of a machine for a given power output depends on its speed.—The Electric Journal.

DISCUSSION.

Sporadic Insulator Troubles.

(These papers are reports of the discussion following the reading of a number of papers at a symposium on the subject of sporadic insulator troubles at the November meeting of the San Francisco Section of the American Institute of Electrcal Engineers.—The Editor.)

A. H. Babcock:—Sometimes a dielectric acts as though there might be such a quality as "fatigue" in insulation; for example, the insulation of an automobile spark plug is subjected to a periodic charge and discharge. In time it fails to fire the charge. Sometimes it can be repaired by a simple cleaning in gasoline, but whenever such treatment shows a crackeled appearance in the glaze, on the surfaces not exposed to contact with the hot gases, it is past repair and has broken down permanently. When this appearance is observed a delicate finger tip will detect a perceptible roughening of the surface.

With these facts in mind, it is surprising to hear good power men advocating the maintenance of line insulation by a continuous stress under line potential. It seems difficult to picture anything else than a mechanical strain in a dielectric as the effect of an electric stress, (otherwise how could there be a puncture); hence, may there not be a phenomenon of "fatigue of insulation" as there is fatigue in steel.

Harris J. Ryan:—One can agree with Mr. Babcock that there may be such a thing as "fatigue of insulation." In these matters, results are radically different according as the stressing voltage is below or above the ionizing value. All substances are pervaded with some electrified or ionized matter. Everything contains to some extent natural ions. Under electric stress these ions are moved about somewhat, even in solid dielectrics of high quality. When the stressing voltage is high enough such natural ions are moved with sufficient violence to ionize neutral material in and about the main dielectric of the insulator. Further increase in the voltage produces a prolific increase of ionization, resulting in heavy conduction, intense heating and early rupture of the dielectric. Insulators subjected to ionizing voltage are overstressed, and physical changes and failure rapidly develop.

Mechanical fatigue relates to the failure of material under prolonged duty below the structural distortion limit. Correspondingly electrical fatigue of a dielectric must relate to failure under prolonged duty below the limit of ionizing stress, above which physical injury and failure rapidly develop.

We all know the "soaking in" of the charge in a condenser. It is fairly common knowledge, too, that every dielectric displays actual conduction to some extent; it is known, too, that such conduction is in part electrolytic in character.* Thus it is an established fact that when the lower non-ionizing voltage is applied through the dielectric of an insulator, electrified matter or ions are actually driven through it bodily. It stands to reason that a long continuation of this process must bring about physical changes of some sort. It may well be that such changes are the direct or indirect cause of the ultimate failure of some insulators. In this phenomenon the character of electrode contact by which the charging current is led to and from the dielectric is bound to be of some importance. In the suspension type insulator the actual electrode in contact with the porcelain cap is neat Portland cement. This material has presumably the composite properties of a conductor, an electrolyte and a dielectric. In respect to either, its properties are poor, and decidedly irreguar and unstable. Materials haveing these

* J. A. Fleming and S. B. Dyke. Power Factor and Conductivity of Dielectrics; Conclusions, Electrician (London) Vol. 69, p. 11, April 12, 1912.

properties always conduct current along seams.† The seams are electrolytes or conductors and the rest of the material is a dielectric, carrying no current. Thus when charging current is conducted from the hardware through an electrode of cement to the surface of the porcelain cap of an insulator the density of such current as it enters the porcelain must be most irregularly distributed, intense in some places and almost absent at others. Local overstresses that lead to failure may thus occur—producing apparent fatigue. The results that develop with time in actions of the above sort should be made the object of close and prolonged study.

F. G. Baum:—Mr. Edison said the other day that ultimately the human being should work almost continuously and sleep not at all. I don't believe we should apply that to people but I do believe it should be applied to all electrical apparatus, as electrical apparatus probably deteriorates less when continuously working than when intermittently idle and working. Some people should sleep all the time for best economy.

Mr. Woodbridge remarked that a large part of their trouble on transmission line insulators came from building up the line each morning. We found in operating the Pacific Gas & Electric Company power lines in 1902 that we got better results by keeping all lines in service than we could get by retaining one out of service as a "spare." When the line is kept at full potential the insulators do not collect so much dust and moisture and are kept more or less warm (when line is "hot") so that condensation is less.

The same thing I found true of generators as machines that gave trouble when taken out of service every day gave little trouble when kept continually in service. The reason here I think, is that the copper and insulation and iron expand differently and by running hot and then allowing to cool we have a strain and a motion between the conductors and insulation. This motion gradually causes damage to the insulation and ultimately causes failure.

The high factor of safety of all kinds of transformers is largely due to the fact that temperature changes and atmospheric changes are largely avoided. And I believe it is generally true that electrical apparatus is less liable to deterioration when kept in service continually.

H. A. Laidlaw:—The experience of a large company operating in the central part of this state is, I think, of interest in connection with this discussion. The particular line which I have in mind operates at approximately 60,000 volts star connected with solidly grounded neutral. Originally, this line was, I believe, built for 40 kv. and when changed to 60 kv. some eight or ten years ago a special construction or extension was used to obtain the additional spacing deemed necessary. Most of the poles are about 35 ft. out of ground. As reconstructed, the conductors are spaced in an equalateral triangle of approximately 84 in.

The special construction or extension consists of two pieces of L iron fastened to the pole with U bolts and projecting above the pole tops about four ft. A 3½ in. pipe terminating in a metal top pin carrying the top insulator is bolted to the pole between the two pieces of L iron and is also held under the U bolt which holds the L irons.

A wooden crossarm is bolted to the L irons at a point approximately 1 ft. above the pole tops. Iron pipe pins carrying the insulators are used in this arm. There are a great many poles in this line and other lines passing through approximately the same territory, exposed to the same climatic conditions and voltage in fact normally operating in parallel with the line in question which are not provided with the extension. The spacing of conductors is the same on these poles as on the poles carrying the extension. The construction consists of a wooden cross arm bolted directly to the pole and braced with wooden quarter braces, the insulators being carried on iron pipe pins in this arm. The top insulator is carried on an iron pipe pin bolted to the top of the pole.

Although the line carrying the extension is approximately 100 miles long there is practically no trouble from insulator failure, leakage or burning poles while a great deal of trouble has been experienced from burning pole tops and crossarms on the poles not provided with this extension. The greater number of cases of trouble are at the top pin, the top of the pole being burned off. Occasionally the arms are burned off where the pins pass through them and sometimes the pole is burned off at the point where the arm is bolted on. Insulators are of the same type purchased at the same time and are apparently identical on both types of structure.

I am not prepared to offer any theory as to why no trouble is experienced when the extension is used unless it is that the relatively large amount of metal in the construction has something to do with it.

This same company has had some trouble with wooden rods operating the auxiliary switches of high tension series relays which, I believe, will be of interest.

They have installed several 60 kv. auto outdoor oil switches. The auto trips of these switches are controlled by solenoids directly in series with the high tension line. The cores of these solenoids are so connected by teated round wooden rods 9 ft. long and ⅜ in. diameter to small knife switches controlling the low tension tripping circuit. On some of these installations the rods are in one piece, while some have rods of same dimensions but made up of three 3 ft. lengths fastened together by brass ferules. These rods are right out in the weather and not protected in any way from rain, dust, etc.

A great deal of trouble has been experienced by the burning of the rods where they are made in one continuous piece while those made up in sections have caused no trouble.

While the number of these installations is too few to give results of any particular significance, it seems to me possible that the mass of metal in the ferules may have some bearing on the better results with the rods made up in sections.

† C. P. Steinmetz. Discussion. Core-Conduction Phenomena. Trans. A. I. E. E., Vol. XXX, p. 92, Jan. 1911.

The railless street cars recently shipped from England for use in Shanghai have been temporarily abandoned because of the conditions of the streets on which they were operated. It seems that the foundations of these streets or roads were originally of broken brick which in the course of years have become pulverized into mud. This cannot support the weight of the cars. It was found that the wheels of the new cars were pressing down the surface stones with which the roads are paved, and it seems that these roads will have to be gone over thoroughly before the operation of the railless cars can be undertaken successfully. Aside from the difficulty with the roadbeds, the cars are said to be eminently suited for use on the traffic-packed streets of Shanghai, being able to work their ways through narrow roads where it would be impracticable to operate vehicles fixed on rails. In the period of 13 days during which the cars were run 200,000 passengers were carried thereon, the cars on the streets numbering about 5 each day. It is reported that the management of the Shanghai electric street car lines is convinced that if the difficulty with the road surfacing can be overcome there is a bright future in Shanghai for the railless street car.

INDUSTRIAL USES OF FUEL OIL

BY F. B. DUNN.

Oil in the Iron and Steel Industries.

[Concluded.]

The value of a pyrometer in the open hearth furnace is well illustrated by the following data, taken while making semi-mild steel:

Temperature of furnace	2,876° F.
Temperature of gases at chamber	1,832° F.
Temperature of gases at stack	540° F.
Temperature of atmosphere	70° F.
Temperature of air entering furnace	700° F.
Temperature of molten steel in ladle	2,902° F.
Heat units in the oil	18,840 B.t.u.
Oil per ton of metal	42 gals.

From these data the heat balance can be computed; that is, the consumption of heat units may be itemized to determine where the losses are taking place, and to show the economy obtained by preheating the air for combustion.

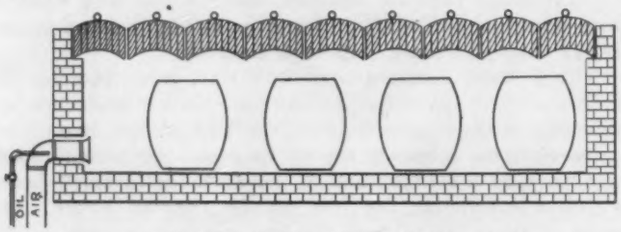


Fig. 69. Crucible Steel Furnace.

Analysis of oil:

C-85.6	Sulphur	.9395
H-11.89	Weight per gallon	7.83
O-0.9	B.t.u.	18,840
N-.52		
S-1.09		

From table on oxygen and air required for combustion:

Carbon $.856 \times 2.667 =$ 2.283 lb. oxygen needed.

Hydrogen $(.1189 - \frac{.009}{8}) \times 8 =$ .942

Sulphur $.0109 \times 1 =$ .01

3.236 lb. oxygen needed.

As one pound of oxygen is contained in 4.32 pounds of air, the total air required per pound of combustible is $3.236 \times 4.32 = 13.98$ lb.

The weight of combustible per pound of fuel is: .856+.1189+.0109=,986, and the theoretical amount of air is 13.98 divided by .986=14.18 lbs.×12.39=175 cu. ft. of air per pound of fuel. One barrel of oil weighs 328.86×175=57,500 cu. ft. of air per barrel. Specific heat of air=.0189 $(T^1 - T) + .0000009 (T^2 - t^2)$.

Heat in air=57,500 (.0189(700—70)+.0000009 (490000—4900)=709,500 B.t.u. heat entering furnace with the air per barrel of oil. The per cent gained by preheating the air to 700° F. is shown as follows:

328.86×18840=6,195,722 B.t.u. per barrel of oil.

Then $\frac{709.500}{6,195,722} \times 100 = 11.45\%$ heat gained by preheating the air.

B.t.u. required to heat furnace to 2876° F.=57,500 (.0189(2876 — 700) + .0000009 (8271376 — 490000)= 2,760,000 B.t.u.

B.t.u. absorbed by one ton of charge=2240× (.0189(2876—70)+.0000009 (8271376—4900)=137,000 B.t.u.

Loss due to heat carried away by steam formed by the burning of hydrogen=9×.1189 (212—70)+ 970.4+.48 (1832°—212)=2020×328.86—665,000 B.t.u.

Loss due to escaping gases at stack=14.18×.24 (540—70)=1600×328.86=526,500 B.t.u.

As 42 gallons of oil were consumed per ton of metal we have:

	Per cent.	B.t.u. per bbl. oil.
Heat absorbed by furnace	44.7	2,760,000
Heat absorbed by charge	2.22	137,000
Loss due to heat carried away by steam formed by the burning of hydrogen	10.75	665,000
Loss due to heat carried away in dry chimney gases	8.5	526,500
Losses due to radiation	33.83	2,107,000
Total	100.00	6,196,000
Heat gained by preheating air	11	709,500
Actual heat loss by radiation	27.9	1,397,000
Per cent of radiation losses recovered by preheating air in chamber	33.6	

It is interesting to note the small percentage of heat absorbed by the charge. The amount of latent heat of fusion or the heat absorbed by the charge during the process of changing to a fluid is very small, being about 45 B.t.u. per pound or 56,000 B.t.u. per ton. The furnace was probably heated a few degrees more than was absolutely necessary, but the charge was not thoroughly melted until a temperature of 2720 was reached. The heat losses due to radiation are rather high, but it is hard to determine just where they take place on account of the high temperature of the gases leaving the furnace. We have ascertained that 33.6 of these losses have been recovered, due to the preheating of the air for combustion in the regenerative chambers. The amount recovered could probably be increased by rearranging the checker brick in the regenerative chambers, as many open-hearth kilns have the preheated air at a much higher temperature.

Pyrometers are of great value in connection with the heat treatment of steel or other metals, as they make possible the accurate determination of the high temperatures encountered. When heating for hardening, the temperature can be maintained steadily at the point which has given the best results in practice. The correct hardening temperature for any carbon steel can be determined accurately by the use of a pyrometer. When testing a piece of steel with this apparatus, the temperature indicated by the meter rises uniformly until the metal is heated to a certain point, at which it continues to absorb heat without appreciably rising in temperature. This is called the "point of decalescence." At this temperature, the indicating pointer of the meter remains stationary, the added heat being consumed by internal changes. When these changes are completed, the temperature again rises. The point of decalescence should be carefully noted, and as soon as temperature begins to rise above it the steel should be removed from the furnace and allowed to cool slowly, for overheating at this critical point has a tendency to lessen the hardness of the steel. When it has cooled to the proper color, it is cooled by plunging into oil.

The purpose of annealing steel is to soften it for machining, and also to remove all stress due to rolling or hammering. The temperature for annealing should be slightly above the critical point, which varies with different steels. This temperature should be maintained just long enough to heat the entire piece evenly; care should be taken not to heat the steel much above the hardening point for when steel is heated above this temperature it becomes coarse. Overheated steel that is not actually burned can be partly restored by heating it to the proper temperature and allowing it to cool slowly in hot ashes or sand; after this process it must be hardened again at the proper tempering heat.

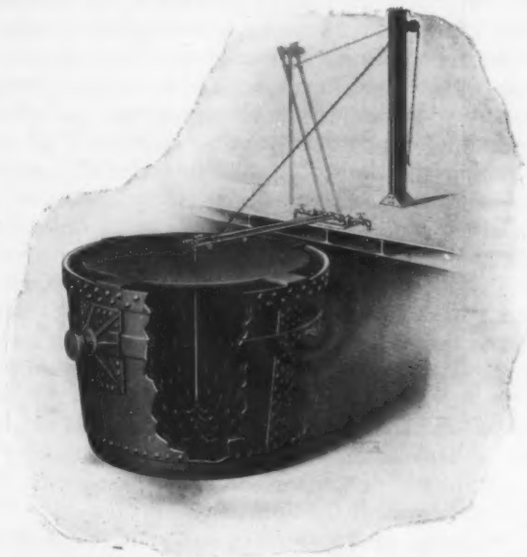


Fig. 70. Ladle-Drying and Heating Oil Burner.

The presence of scale on the surface of hardened steel is due to oxidation when hot; consequently, to prevent scale the heated steel must not be exposed to the action of the air. When using an oven heating furnace, the flame should be so regulated that it is not visible in the heating chambers.

Miscellaneous Applications.

Fig. 69 illustrates a home-made crucible furnace. This furnace holds from five to six crucibles containing 150 lb. per pot, and a furnace temperature of 3500° F. maintained on a consumption of 10 gal. of oil per hour. The air for combustion is supplied by a No. 4 blower; the pressure of oil at the burner is 20 lb. and the pressure of the air used as an atomizing agent is 20 lb.

The consumption of oil in billet-heating furnaces varies with the size of the furnace. Some require as much as 21 gal. of oil per ton of steel, while one report shows a large continuous billet furnace operating on 14 2/10 gal. per ton of steel and heating 360 tons per day of 24 hours. Great care must be taken in the heating of steel before rolling, for the strength and ductility depend to a large extent upon fineness of the grain and this may be obtained only by having the temperature of the steel rather low during the finishing stage of rolling 1300° to 1400° F., or a dull red heat, giving the best results.

Fig. 70 illustrates the application and use of the ladle drying burner. It is provided with a swinging stand and is located at a convenient place on the charging floor, or bolted against the columns of the building. It is arranged to lower into the ladle when in use, and to raise up when not in service. A long nozzle is proved for reaching well down into the bottom of the ladle so that the heat is evenly distributed over the bottom and up the sides. A sheet iron cover is put over the lable to protect the burner and retain the heat and help to distribute it to the sides of the ladle.

LETTER TO THE EDITOR.

Burning Oil With Bagasse.

Sir: The articles on "Industrial Uses of Fuel Oil" by F. B. Dunn have proven to be of great interest to me and to many others of your readers and, as they will doubtless appear in book form later, I take this opportunity of pointing out a few errors which appeared in the February 20th issue of your valuable paper wherein Mr. Dunn discusses "Burning Oil With Bagasse" under the above general topic. I do this with the very best of intentions and I trust that your readers and Mr. Dunn will accept the following criticism in the spirit in which it is made.

Let me point out, first, that the word "bagasse" contains only one "g," being derived undoubtedly from the Spanish "bagazo" which in turn is taken from the word "megass" (derived, by the way, from the French) which is applied to the refuse from cane crushing rolls in all British and French possessions. The word "bagasse" is, however, becoming more and more universally used and has always been the term in vogue in America.

I fear that Mr. Dunn has misapplied the term "macerated" pulp—does he not mean "lacerated"? The term "maceration," as used in raw sugar factories, is "applied water" or "water of imbition" being the water which is added to the cane as it passes through the series of crushing rolls to facilitate the extraction of the sucrose. The bagasse leaving the final set of rolls is certainly not "macerated" for its use as a fuel demands that it be in as dry a state as it is possible to obtain by mechanical means.

Every refinery is a sugar factory in the accepted sense but all sugar factories are not refineries. Almost universally throughout the cane growing countries of the world only a raw brown sugar is manufactured, which is subsequently "refined" for table use at refineries located near centers of population, where fuel, such as coal or oil, is relatively cheap. The refineries in the Potrero District of San Francisco and at Crockett, California, are typical installations.

In any raw sugar factory today where cane milling is reasonably up to modern standards, the bagasse is available for use as fuel immediately after its passing through the final set of rollers and this bagasse is certainly not "allowed to go to waste," to quote from the article in question. Extra fuel—the term applied

to fuel used in a sugar factory other than bagasse—should not be required where the proportion of fiber in the cane is in the neighborhood of 11 per cent. It must be borne in mind that the factor which, in nearly all cases, determines whether or not extra fuel is to be used in a factory is the quantity of "maceration" water applied, for any added water must subsequently be evaporated from the cane juice, which process, of course, requires heat and, therefore, fuel. Where the fiber in the cane is low and no extra fuel is used this maceration seldom exceeds 25 per cent on juice in cane, whereas, with auxiliary fuel, this figure may be as high as 45 per cent.

Mr. Dunn is quite correct in saying that in Cuba extra fuel in the form of wood is extensively used, but wherever this condition exists, it is because what may be termed "first principles" in thermal engineering have not been applied. A sugar factory is essentially a "heat-utilization factory" as all exhaust steam from engines and pumps is utilized in evaporating the cane juices at first to a syrup and then to a "massecuite" (molasses and sugar crystals) and where proper attention is paid to insulation of all exposed heat radiating surfaces and where "pre-heaters" and "pre-evaporators" are installed, the supply of bagasse is always sufficient for usual needs. True, one or two of the most modern of Cuba's factories use an amazing quantity of extra fuel, but investigation will show that it is because condensers have been used in connection with prime movers, the result being that the latter make a good showing on the score of steam consumption, but valuable heat, which should be used in evaporating water from juices, is lost, which heat, of course, has to be replaced, for which purpose the output of bagasse is insufficient.

I challenge the statement that "almost every refinery has furnaces equipped to burn bagasse and oil," because, in the first place, a refinery has, by its very nature, no bagasse to burn and because 90 per cent of the world's sugar factories do not burn oil—much less any extra fuel at all. Of the 45 factories here in Hawaii, only about six use extra fuel and this because the fiber content of the cane is low and in consequence there is normally an insufficiency of bagasse and the maceration is high. As to "getting up steam when boilers are cold" nearly all factories have sufficient surplus bagasse on hand at all times for the purpose, especially where they are operated continuously, day and night, with the exception of Sundays.

I do not know Mr. Dunn's authority for the statement that the moisture content of Cuban bagasse is 42.50 per cent (unless it be the 1913 edition of the Babcock & Wilcox Company's "Steam") and it will be noted that this figure is the lowest of the five given, the remaining four giving an average of 51.25, but here in Hawaii, where the art of cane crushing is as highly developed as anywhere in the world, the average moisture content of bagasse for the 1914 season was 45.72 per cent. I venture to say that the average moisture content of Cuban bagasse is not less than 47.50 per cent, while in Louisiana, where cane is cropped yearly, as against every 18 months in tropical countries, and the cane fibre is soft and does not lend itself any too well to the process of crushing, the moisture content of the bagasse is not under 50 per cent.

The term "extraction" as used by Mr. Dunn in discussing Louisiana conditions, is an ambiguous one. Is extraction of "juice" meant or "sucrose" extraction? The former is generally about 80 per cent and the latter near 95 per cent in Hawaii. The relative degree of extraction does not materially affect the fuel value of bagasse. While it is agreed that a bagasse rich in sugar has a higher B.t.u. value than one in which the sucrose is low, this advantage is offset by the fact that sugar, when burned in combination with cane fiber as bagasse, gives rise to a great quantity of clinker which retards proper combustion. The commercial fuel value of bagasse is dependent upon its mechanical condition. Finely ground bagasse, reminding one of sawdust, burns with difficulty and requires an excess of air for proper combustion, but furnace design, which is constantly being improved, is rapidly overcoming this objection. While the Dutch oven type of furnace is universally used for the burning of bagasse, the step ladder grate finds great favor rather than the flat grate illustrated in Mr. Dunn's article, as a full grate is always assured and air leakage prevented. High bridge walls are a necessity, as well as air ports, for the admission and regulation of an auxiliary air supply, the aim being to have combustion take place within the furnace and not under the boiler. Where oil is used the burners are not placed as shown in the above mentioned cut but at the back of the main combustion chamber the flame passing from the rear to the front of the furnace.

The figure of 8 gallons of fuel oil per ton of cane as given by Mr. Dunn is unusually high. In Hawaii 1.5 gallons per ton is considered sufficient. To point out how unnecessary is the use of extra fuel in the sugar house, under Hawaiian conditions, I might cite the case of a local plantation which, in 1913, used $21,000 worth of fuel oil. By carefully insulating all surfaces against heat radiation to a degree never before attempted in Hawaii, the 1914 campaign was negotiated without extra fuel. If sugar factories were designed with the care given modern power plants, particularly with reference to the question of heat losses, oil fuel, or in fact any kind of fuel other than bagasse, would be unnecessary in tropical or semi-tropical countries.

The figures of 18 per cent and 9.5 per cent as representing the sucrose and fibre content of sugar cane, are not altogether representative. I doubt very much if 18 per cent sucrose cane has been produced on a commercial scale in large quantities. The average figures for the past seven years in Hawaii, taken from not less than 31,000,000 tons of cane, are 14.25 per cent and 12.50 per cent for sucrose and fiber, reespectively.

Trusting that both your readers and Mr. Dunn will consider the above as purely constructive criticism, I am,

Very truly yours,

R. RENTON HIND.

Ewa, Hawaii, March 6, 1915.

INSIDE WIRING METHODS

By JOHN CARRELL

Setting Outlet Boxes.

The first actual construction for the journeymen, in new buildings, is to set the outlet boxes. A workman places a stepladder in about the center of a room and ascends with a long stick in his hand. He wants to know three things: (1) The exact center of the room; (2) distance between joists adjacent to center; (3) distance from nearest joist to center. He lays his long stick parallel with the edge of the joist with one end extending to the wall of the room and places a mark on the joist; he reverses the stick, and, with one end extended to the opposite wall, places another mark on the joist so that the half-way point between the two marks is on the middle point of the room. The operation is repeated with the stick transverse with the joists; but this time a small finishing nail is inserted in the stick at the edge of the first joist from the apparent center. When the stick is reversed a rule is placed to take the distance between the small nail and edge of aforesaid joist, and also the length of required backing and position of the box thereon. On the floor he cuts the backing from a 2x4, secures the box thereto by means of wood screws, reascends the ladder and nails the backing in place so that the outer edge of box will be flush with the finished plaster line. This is the mechanical procedure on Class C and frame buildings where partitions are in place.

Very often a Class C building is ready for running conduit before any flooring is laid and only bearing partitions and walls are in place. It is intended that conduit shall be run in notches in the upper edge of joists. The location of outlets must be measured from plans and checked with actual measurements from the building. If there are to be many outlets in a row, a blue chalk line may be snapped on joists. The distance from outside wall, or other dependable point, to each outlet marked on a small piece of planed board, a steel tape stretched and, on a joist adjacent to each outlet, the two measurements for the backing are chalked. Sometimes only the backing, with holes for conduit are placed in position at this stage of construction. Often with Class C buildings which have several typical floors, such as in many apartment houses and hotels, the location of outlets on the top floor are found and from each location a plumb line dropped, thus getting the outlet locations for each floor with one set of measurements.

At times, the form of a building necessitates laying out the outlet points on the floor, whence they are transferred to the ceiling by means of a plumb-bob and line. This is an economical method for conduit work, because the workmen may preserve the measurements for the cutting of ducts.

A convenient apparatus for finding centers in buildings where there are a large number of medium sized rooms is the slide-stick. Two sticks made equal in length, each 10 to 12 ft, long, are graduated in feet, and the last 3 or 4 ft. in inches also. The sticks are bound together with metal straps so they will slide and so that the respective numbers read in the opposite direction; for instance, if two sticks 12 ft. long are used, zero on one will be opposite 12 on the other. When the sticks are extended to measure a room the center will be the point where two equal numbers meet.

Locating brackets and flush switches involve two measurements, height and position indicated on plans. Often plans show switches and brackets located behind doors, in which case the journeymen use their better judgment. Because partitions are usually too narrow for a 2 x 4 backing, one of ⅞ in. stock is used. For flush switches in knob and tube work these are inserted between studs to abutt the back of lath, the box protruding through to the plaster line. Almost any stock may be used for flush backing except redwood which causes stains to appear in the finished plaster.

Where outlet boxes are to be embedded in concrete great accuracy is required in finding locations. In many cases only the outer walls and a very few bearing partitions are available. Measurements are taken from the outer edge of outside walls and all intermediate distances carefully checked with the overall distance. For ceiling outlets a hole is bored in the wooden form to serve as a marker and also as a drain for the box. When the conduits are entered and plugged the boxes are nailed to the form. For boxes to be set in concrete walls, a hole the size of the cover is made in the form, pairs of steel wires inserted through screw holes in the boxes are brought through the covers and fastened to nails driven in the outside of forms. Conduits are entered into the boxes, fastened with locknuts and gas caps placed on ends, to be replaced later with bushings. The use of gas caps is of importance because the backing up of concrete in the conduit is of frequent occurrence, even though it may appear that such an accident is not probable.

In ceilings constructed of metal runners and wire lath, outlet boxes are fastened to backings of channel iron by means of stove bolts, pieces of the channel studding being employed. Side wall boxes are fastened in the same manner if double studding is used. Where flush switches are to be placed in 2 in. partitions consisting of only single studding and lath, the boxes used are just large enough to contain a shallow switch and are held in place by tying the conduit to the wire lath. In order to save time many contractors figure on allowing the edges of boxes to protrude from the plaster of these shallow partitions and the use of a small wooden mat under the switch plate.

Outlet boxes used in standard construction on new buildings should be of medium depth (about 1½ in.) and should be installed so that the outer edges are flush with the finished surfaces. For conduit or armored cable work boxes are round, octagon or square in shape 4 or 4 11-16 inches in width and are equipped with open canopy covers. Where outlets serve as junc-

tions for many conduits, where large conduits are used and where many splices at the outlets are necessary, boxes having a depth of 2¼ inches are employed.

For knob and tube work boxes are round or octagon in shape, 3¼ inches in width and are usually provided with drilled and tapped lugs to hold covers or receptacles. In many places shallow boxes having a depth of ¾ in. mounted on backing set flush with back of lath are used. For this class of work the shallow boxes serve equally as well as the medium box.

Straight electric outlet boxes are provided with fixture studs, secured to the box by two or more stove bolts. Fixture studs for ceiling outlets should have ½ pipe threads, for brackets, ⅜ pipe threads.

Sometimes pendant fixtures of great weight are to be installed and the ordinary method of supporting will not suffice, in which case specially made hangers, usually of pipe, are secured in ceiling timbers or other construction, a threaded end protruding into the box instead of the fixture stud.

For combination outlets, boxes are provided with bonding clamps fastened in the same manner as fixture studs and arranged to be firmly secured to the gas pipes.

For concealed work in existing buildings shallow boxes or plates may be used without cutting the structure of the surface. Shallow boxes are round in shape, 3¼ to 5 in. in width and with depths of ½ and ¾ in. For securing an outlet box or plate to a metal ceiling, toggle bolts are used, and if the job is properly done a fixture above the ordinary weight may be suspended therefrom. For buildings having wooden joists backing may be inserted for ceiling outlets, though a pocket in the floor above or from the attic, but if this is not feasible the box is placed so as to overlap a floor joist or furring strips, moving the box a few inches from the center, if necessary. For bracket outlets the procedure is practically the same, the box being set so as to overlap a stud. To set switch a box in a partition a section of one lath the width of the box is completely removed and a part of each adjacent lath cut away, a small mat of hard wood, to which the box is fastened, is secured to the lath with screws. No feasible way to insert and secure a backing under wooden lath and plaster has yet been advanced.

Electrical contractors carefully observe all the outlets; the business deals largely with them. Outlets are the points from which the estimator will weave his web of wiring data; they are the wiring points which the workmen must locate before proceeding with the work; they are the indicating points by which the customer will gauge, with respect to quantity, the value of the service rendered him; in fact the number, capacity and location of the outlets compose the quantity index of the installation for everything except the accurate wiring costs which flow into the job. Electrical business men should also closely watch the flow at the spigot.

The sensitiveness of crystal detectors for wireless signals can be greatly increased by exposures in contact with radium. An unresponsive galena crystal has been made satisfactorily sensitive after three hours exposure to 1-10 gm. radium bromide.

NECESSITY FOR CONDUIT WIRING.

BY A. J. ELEY.

(This paper regarding the electrical fire hazard of knob and tube wiring was read at a meeting of the Los Angeles Jovian League, March 10, 1915. The author is chief engineer for the Los Angeles Fire Department.—The Editor.)

There is one particular item in regard to electrical fire hazard that I would respectfully call to the attention of the members present, viz: open wiring in buildings, or the present system of tube and knob wiring, which, as the result of investigation after fires, the fire department considers a dangerous factor, and which could be greatly eliminated by the use of conduits for such wiring in place of the tube and knob system; and several months ago the fire commission recommended to the city council the adoption of the following ordinance:

"All wires hereafter installed in or on all buildings or other structures in the City of Los Angeles, as the same are now, or may hereafter be defined in the building law of the City of Los Angeles, and used for the purpose of conducting electricity, shall be enclosed in approved conduits or armored cables."

This recommendation was approved by the city electrician, and following are the principal reasons for my recommending the passage of such ordinance:

For numerous reasons the present system of knob and tube wiring now installed in all but Class A buildings greatly increases the fire hazard, while the conduit system of electrical construction makes a much better mechanical and a more permanent job, thoroughly protecting the wires, and eliminating practically all possibility of fire from electric wiring. Stop and think of the importance of requiring all wires to be in conduits—the elimination of a large percentage of the fires in Los Angeles. With the present knob and tube system, the wires are exposed in the attics and nearly everyone stores such things as old furniture, clothes and boxes of inflammable material in their attics and pay little attention to keeping them away from the wires. The Board of Fire Underwriters and the Electrical Inspector demand that the wire clear the wood and other inflammable materials at least one inch, and yet in thousands of residences in this city today such material is in contact with the wires. When the wires are installed in rigid iron conduit, they are at all time amply protected.

When the electrician has left the building and the electrical inspector has approved the job, the lathers have not done their work nor have the carpenters finished. The writer has seen hundreds of cases where lath and other lumber has been nailed solidly against the wires. Instances can be cited where nails have been driven through the insulation of the wire against the copper, thereby bringing the electric current in contact with the wood. When an owner wants an additional outlet for a light or heating device, he often either does the work himself or lets his boy or some friend do it, all of whom are ignorant of the proper construction. If additions are built the carpenter often does the electric work, in which case it is practically never done correctly. Frequently boys tap onto the wires to obtain current for various electrical toys or for wireless apparatus. Some actual

examples of what is done in these cases are, using bare wire, running ordinary lamp cord down partitions, tacking it to casings and baseboards, and leaving the loose ends of wire lying around. Also circuits are overloaded and poor joints are made. An overloaded circuit may heat the wires to such an extent that the insulation burns off, drops on the lath and the building is set on fire. Poor joints may arc and cause the same result. Work of this kind would be instantly condemned by the inspector, but the person doing it does not even take out a permit, and it is therefore never seen by an inspector. The entire electric system of a building might as well be done in this ridiculous manner as any part of it, for "A chain is no stronger than its weakest link." If conduit construction were installed the wires would be well protected and when additional outlets were needed the services of an electrician would have to be obtained.

Practically all of the large cities in the United States have conduit ordinances. They are recommended by fire departments, boards of fire underwriters, and city electrical department throughout the country. On all mercantile buildings, other than frame, the key rate of interest is 2 per cent less on buildings wired in conduit than for those wired with knobs and tubes.

There are many more reasons in favor of the use of conduit that the length of this article will not permit us to discuss, but there is only one argument against it, and that is the slight increase in cost over knob and tube work, which additional cost is almost negligible as statistics show that it will average only six-tenths of 1 per cent of the cost of the building.

Everyone of us should encourage the passing of an ordinance which will eliminate a large percentage of the loss by fire of life and property.

Small Motor Starting Devices and Their Dangers.

The persistent investigation of fires, seemingly of electric origin, often brings to light some condition of construction or installation, which can readily be modified in the future, and so reduce the chances of trouble.

It has been proved that a number of fires have resulted from the use of the old style starting boxes, and their elimination should be beneficial.

Sewing machines, on which a wooden top has been placed to carry head of machine, and a portion of the iron framework cut away to admit of placing the motor, and converted foot-drive to motor-drive, are frequently found in small lofts and dress design rooms, and furnish a strong argument for the periodical re-survey of all electrical equipment.

For instance, from the report of a fire in which a sewing machine caught fire from the motor, it was found that the retractile spring of the rheostat arm had been missing for a week, and in order to make the treadle stay up (or in "off" position) the operator had so adjusted the treadle pins as to make the friction compensate for the gravity. The motor, like all those used for this purpose, was series wound for 120 volts direct current, and designed to come up to full speed almost instantaneously.

The electrician had removed the plug fuses prior to the investigation. This lent color to the belief that the circuit had been heavily over-fused.

From the above facts the belief was that either the jarring of the building caused the treadle to fall, or the cat, kept in such loft, stepped on it and depressed it. At any rate it must have moved into the full—or position whereon the motor started to run continuously. The run—intermittent run—the snarling of the thread, the heating of the bearings, any and all of these contributed to the overload, held in by the heavy fuse, which started the fire.

We should appreciate the importance of requiring that the danger caused by a broken retractile spring shall in some way be guarded against in the design of installation of these motor-starting devices.

These investigations, and others, point very definitely to a need for:

1. Enclosing all live metal parts.
2. Designing the rheostat so it will be inoperative with the cover open.
3. The placing of heat insulation between the motor and the machine top.
4. Rendering it impossible to start the motor while the break is set.
5. Providing some means of guarding against a broken retractile spring so that the motor cannot accidentally be set to run at full speed.

Electrolytic iron is manufactured in France to compete with Swedish iron, and is also applied to the direct manufacture of seamless tubes. Using any pig iron in solution, it is possible to get a product containing one-sixth as much carbon, one-fourth as much silica and one-eighth as much phosphorus as is found in ordinary malleable iron. It has excellent electric and magnetic properties, and is well adapted for the manufacture of motors and transformers, as the weight can be reduced and the capacity increased. Under European conditions the cost varies from $29 to $37 per ton, depending on the cost of pig iron and electric power.

The annual report of the Bell system of the American Telephone & Telegraph Company shows that at the end of 1914 this system had 8,648,993 subscribers' stations, reaching 70,000 towns, as compared with less than 60,000 post offices, railroad stations and telegraph offices at 25,000 places. There are over 15,000,000 miles of exchange wires and 2,400,000 miles of toll wires, and an average of 27,848,000 calls per day. The gross revenue was $226,000,000; an increase of over $10,000,000 over 1913. Of this, operation consumed $81,400,000; taxes, $12,200,000, or 1.54 per cent on the outstanding capital obligations; current maintenance, $31,600,000; and provision for depreciation, $41,500,000. The surplus available for charges, etc., was $59,300,000, of which over $18,900,000 was paid in interest and $30,300,000 was paid in dividends.

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Electro-Chemical Opportunities

Attention has frequently been called in these columns to the great opportunities which the Pacific Coast offers for the development of electro-chemical industries. The leading article of this issue gives the details of an operating plant producing bleaching liquid by electro-chemical means. Although this is operating on a comparatively small scale, it demonstrates the feasibility and desirability of a chemical plant as an off-peak consumer for electric power.

A large portion of the paper is also concerned with a discussion of the subject of the fixation of atmospheric nitrogen by the potent aid of electricity. Many processes have been perfected so as to accomplish this result, but from a business standpoint Western central stations have not yet offered a rate sufficiently attractive to induce capital to make the venture.

The Pacific Coast offers an excellent market for nitrogen products, both as fertilizer and as an essential constituent of explosives. Students of economics are agreed that it is desirable for the United States to become independent of foreign sources of nitrogen. Central stations and public service commissions now recognize that it is possible to give a very low rate for this kind of a load. So, taking all in all, there is little doubt but what the next few years will witness the establishment of this new industry on a large scale.

New Honors for Professor Ryan

When plans were under way for the International Electrical Congress to be held at San Francisco this year, it was suggested that some Pacific Coast electrical man should be elected president of the American Institute of Electrical Engineers. The choice of the West was Harris J. Ryan, professor of electrical engineering at Stanford University. Professor Ryan, however, felt unable to accept the nomination and as the congress has been called off because of the European war, no other candidate was named.

However, it was still felt that Prof. Ryan should be honored and the Pacific Coast represented by his election as vice-president, and, in accordance with official action taken at the Pacific Coast meeting of the Institute last September his name was regularly placed in nomination.

As an especial mark of distinction, however, the directors of the Institute have just appointed Prof. Ryan honorary vice-president, effective immediately. This signal recognition of his many contributions to the advancement of electrical progress insures adequate representation of the Institute at the various meetings which are to be held at San Francisco this year, including the International Engineering Congress and the Panama-Pacific meeting of the Institute. It also obviates the necessity of frequent Eastern trips to attend the regular business meetings of the organization.

At the next annual meeting of the Institute an effort will undoubtedly be made to provide some established form of territorial representation, such as the plan for territorial vice-presidents. But until this

problem has been worked out, the Pacific Coast, at least, can rest assured that it has a most creditable and able representative in Professor Ryan as honorary vice-president.

Captured Capital

Although the criminality of capital has long been the favorite theme of those who do not possess much of the root of all evil, it is somewhat startling to be told that many criminal dollars, together with millions of innocent dollars invested in public utilities, have been effectually imprisoned in the tangled web of modern finance. After capital has once been captured it seems to be condemned to perpetual servitude by the practice of issuing new bonds to retire older issues. Naturally those dollars that are still at liberty are growing wary and cannot be tied up in the public service unless they are assured more freedom of action.

To be specific, previous rulings of the California Railroad Commission have created doubts in the minds of some financiers as to that body's definition of "a net return of eight per cent." Consequently many investors hesitate to put their earnings into public utility securities and insecurities. In order to eliminate this uncertainty and to know the worst, at least, Mr. C. S. S. Forney, president of the Central California Gas Company, has boldly asked to be allowed to earn eight per cent in interest and dividends on stock which has been issued with the sanction of the commission. Mind you, this is in addition to any allowance for sinking fund, depreciation and operation.

According to his argument, public utility stocks now have little or no collateral value as an investment, as distinguished from a speculation. He claims that the rates established by the commission make dividends on stock impossible and needed funds can be secured only by issuing bonds.

A public utility, by the way, is always in need of new money to pay for additions and extensions. It is necessarily a continuing concern and should not be worked to extinction, like a mine. And in order to attract fresh capital it must offer some inducement superior to that held out by other forms of competing investments—industrials, municipals, mines, and the thousand and one other opportunities offered.

Mr. Forney continues that even public utility bonds are not wholly satisfactory, particularly as regards the means, or rather lack of means, available for their retirement. He believes that borrowed money might be returned from earnings as fast as the property depreciates and asks if permission would be given to reduce his funded debt by using the amount reserved for depreciation.

All this is apparently done in the spirit of constructive criticism and is reinforced by many specific citations of the alleged impossibility of doing little more than paying off funded debt under the leading rate decisions which have been established by the commission.

One impressive feature of this argument is that unless some relief is immediately given from the conditions as they now exist, there is little or no incentive for raising the standard of management and efficiency. This is in direct line with the belief that a rate based solely upon the cost of service is inequitable. Some consideration should also be given to the value of the service.

As Mr. Forney's argument is somewhat technical no effort has been made at this time to more than interpret his meaning, so that our readers can understand and discuss the question as to where a utility will secure the money to retire its funded debt.

Sporadic Insulator Troubles

Considerable interest has been aroused by the series of papers on sporadic insulator troubles which have been published in these columns during the past six weeks. Ever since the beginnings of high tension transmission occasional cases of mysterious insulator failures have been reported and the engineer has been at a loss to account for them.

From time to time various explanations have been put forward. Many of them were like the fabled investigation of an elephant by three blind men, each of whom seized upon a different part of the animal's anatomy and vociferously declared that the particular portion which he felt was typical of the entire beast. Mechanical, thermal, chemical and electrical theories have been advanced, but no one theory has sufficed to explain all phenomena.

While it is customary to carelessly call all these mysterious failures sporadic troubles, we would first suggest that the proper distinction be made between sporadic and endemic. It is apparent that the medical precedent used in describing disease is being followed. A sporadic disease is one in which only a few instances occur now and then. An endemic disease is one which is present more constantly, being peculiar to a district or locality. Both are to be distinguished from epidemic, which is common to, or affecting at the same time, a great number.

These mysterious insulator troubles are not epidemic nor are they now so mysterious. Most of them are endemic, being peculiar to coast regions subject to alternate periods of heavy fog and great dust. They are nothing but filth diseases and can be largely averted by cleanliness, a thorough washing eliminating the low-resistance leakage path.

This reduces the number of actual sporadic failures to an infinitesimal proportion of the number of insulators in service. Prof. H. J. Ryan has demonstrated that punctures, similar to those found in practice, may be artificially produced by high frequency current, which has quite possibly been the cause of some failures. Poor porcelain is generally blamed for the remaining cases.

Considering, however, the comparatively few instances which may be ascribed to unreliable porcelain, the question arises as to whether the greater cost of an invariably perfect product would be justified by the insurance against sporadic failures. From the standpoint of dollars and cents the answer has been "no," and consequently the engineer is likely to continue to be puzzled by occasional sporadic failures.

PERSONALS

M. A. Cain of the Cain Electric Company, Santa Cruz, was a recent visitor at San Francisco.

Elmer Dover, Pacific Coast manager and vice-president H. M. Byllesby & Company, is at San Francisco from Tacoma, Wash.

J. Broili of the Nevada Machinery & Electric Company, Reno, Nevada, was a visitor at San Francisco during the week.

C. H. Carter, district manager of the Pacific States Electric Company, Los Angeles, arrived at San Francisco the first of the week.

E. A. Quinn, general superintendent of the San Joaquin Light & Power Company, Fresno, was a recent visitor at San Francisco.

W. N. Chatfield, general manager of the Pacific Power Company, Bodie, Cal., has returned home after a week's stay at San Francisco.

G. M. Plover, electrical contractor of Sonoma county, Cal., spent a few days at San Francisco during the week, enroute to Portland.

W. S. Berry, sales manager of Western Electric Company, San Francisco, returned the last part of the week after a several weeks' trip East.

H. E. Sanderson, Pacific Coast manager for the Bryant Electric Company, has returned to San Francisco from a trip through the Pacific Northwest.

R. Q. McDonald, formerly engineer with the Tonopah Mining Company, Tonopah, Nev., has resigned to go with the Esmeralda Power Company.

Ross Hartley, district manager of the Pacific States Electric Company, Portland, arrived at San Francisco the latter part of last week on a business trip.

W. W. Briggs, general agent of the Great Western Power Company, San Francisco, returned after a business trip through the Sacramento Valley, California.

C. C. Barrick, president of the Union Metal Manufacturing Company, Canton, Ohio, who is touring the Pacific Coast on a business trip, arrived at San Francisco the first part of the week.

A. E. Chandler, consulting engineer at San Francisco, and author of "Elements of Western Water Law," has been appointed a member of the newly-created California Water Commission.

Boyd Ehle, civil engineer of Sanderson & Porter staff, and resident engineer at Victoria for the Victoria Water Works, is spending a short period at San Francisco, seeing the Exposition.

L. B. Wickersham has resigned as assistant general manager of the North Bank, Oregon Trunk and Oregon Electric lines at Portland and has opened an office as consulting engineer in the Ainsworth building of that city.

H. S. G. Hurlbut, formerly general manager of the Pacific Power Company, severed his relations with that company on the first of the month to complete a course of engineering study at the Nebraska Engineering College.

H. G. McConnaughy, secretary of the American Electric Railway Manufacturers' Association, and secretary-treasurer of the Exhibit Committee of the National Electric Light Association is a recent arrival at San Francisco.

C. L. Davis, formerly engineer with the Esmeralda Power Company, Esmeralda, Cal., resigned to accept the position with the Pacific Power Company left vacant by the resignation of D. S. G. Hurlbut of the latter company

J. Q. Brown, general manager of the Nevada Valleys Power Company, and **E. S. Adams,** president of the same company, are in San Francisco after an inspection and business trip of the company's properties in Nevada.

C. E. Ingalls, formerly district manager of the Crocker-Wheeler Company at Los Angeles, Cal., has left for St. Paul, Minn., where he is to become associated with the firm representing the Crocker-Wheeler Company in that city.

J. M. Martin, engineer with the Forest Service at Ogden, Utah, has been called to Washington for a conference with the Chief Forester relative to water power site in the West. Mr. Martin is well acquainted with water power conditions throughout the districts of the west and is well qualified to advise the administration at Washington in the matter of plans for the utilization of the site for water power purposes.

E. Hata, representing the manufacturing interests of the Western Electric Company at Tokyo, Japan, and **M. Matsushiro,** of the Osaka office of the same firm, and representing the Nippon Electric Company of Tokyo, were arrivals at San Francisco from the Orient this week, coming over on the S. S. "Mongolia."After a short stop to see the Exposition, they left for Chicago and the East via Los Angeles, where they expect to remain for some time, looking into manufacturing and office methods of this country.

D. C. Green, well known in western electrical circles, has taken the position of manager of the Salt Lake division of the Utah Power & Light Company's power and electric business. Mr. Green will be in direct charge of the Utah Power & Light Company's light and power business in Salt Lake. Since leasing the electric light and power business in Salt Lake from the Utah Light & Traction Company, the Utah Power & Light Company has created the Salt Lake division, which comprises Salt Lake and its environs served by the company. Mr. Green's position as division manager places him in charge of this company's business in Salt Lake and vicinity. Mr. Green came from Everett, Wash., where he has had charge of gas and electric properties. He formerly held similar positions in San Diego and Monroe, Col., and Marshfield and Albany, Ore.

John W. F. Armstrong, engineering assistant general, construction department Pacific Gas & Electric Company, San Francisco; **Carl D. Benz,** secretary to general manager Pacific Light & Power Corporation, Los Angeles; **Harry J. Bosshart,** power station operator Pacific Gas & Electric Company, Nevada City, Cal.; **Harold W. Bradley,** electrical operator Kern River substation, Pacific Light & Power Corporation; **E. A. Coney,** superintendent meter department City Electric Company, San Francisco; **G. Stanley Covey,** electrical mechanic Washington Water Power Company, Spokane; **O. L. Coward,** sales agent General Electric Company, Seattle; **Glen H. Gardiner,** telephone engineer Pacific Telephone & Telegraph Company, Portland; **Alfred V. Guillon,** sales engineer Pacific Light & Power Corporation, Los Angeles; **S. V. Meicon,** electrician Phoenix Construction Company, Phoenix, Idaho; **Z. P. Meicon,** operator Pacific Light & Power Corporation, Big Creek, Cal.; **L. J. Moore,** chief load dispatcher San Joaquin Light & Power Corporation, Fresno, Cal.; **F. R. McBride,** student University of Oregon; **Geo. R. McDonald,** line and construction foreman Sierra & San Francisco Power Company, San Francisco; **J. S. McNair,** Washington Water Power Company, Spokane; **N. C. Nelson,** overhead distribution engineer City Light Department, Seattle; **Geo. N. Rooker,** manager Northern Idaho & Montana Power Company, Sandpoint, Idaho; **E. R. Stauffacher,** assistant power engineer Southern California Edison Company, Los Angeles; **R. A. Story,** telephone engineer British Columbia Telephone Company, Vancouver; **W. R. Thomas,** superintendent Wenatchee Valley Gas & Electric Company, Wenatchee, Wash., and **Charles C. Tillotson,** chief draughtsman Montana Power Company, Butte, Montana, have been elected associate members of the American Institute of Electrical Engineers.

MEETING NOTICES.

Los Angeles A. I. E. E. Section.

The regular monthly meeting of the L. A. Section of the A. I. E. E. was held at the Chamber of Commerce rooms on March 16th, Chairman Deacon Pyle, presiding. An interesting paper on "The Construction of the Trans-Continental Telephone Line," by D. P. Fullerton, general superintendent of plants of the Pacific Telephone & Telegraph Company, was read by I. F. Dix. Many instructive lantern slides were shown and also two reels of moving pictures taken during the construction of the line. Mr. Dix also showed the picture reels known as "The Spinners of Speech." There was a large and enthusiastic audience.

Portland Jovian League.

The regular weekly luncheon was held Friday noon at the Hotel Benson. The chairman of the day was Mr. C. E. Warner, consulting engineer. The speaker of the day was Wallace R. Struble, secretary Columbia & Snake River Waterways Association, who told of the plans for the dedication of The Dalles-Celilo Canal on May 5, 1915. The following committees were appointed:

Membership:
J. C. Henkle.
Geo. Boring.
S. C. Jaegar.

Finance:
J. E. Davidson.
A. C. Tomlinson.
C. E. Condit.

Publicity:
W. P. Strandborg.
C. R. Bean.

Entertainment:
Robt. Skeen.
John F. Ryan.
L. T. Merwin.

Grievance:
Geo. N. Barker.
O. B. Penrose.

A. I. E. E. Directors' Meeting.

At the regular monthly meeting of the board of directors of the American Institute of Electrical Engineers, March 12, President Lincoln reported that the executive committee recommended that the annual convention of the institute be held at Deer Park, Maryland, June 29-July 2. The recommendation of the executive committee was approved by the board.

The report of the tellers' committee giving the result of its canvass of the nomination ballots received for the offices to be filled at the next annual election was presented. The board then proceeded to select by ballot, as required by the constitution, its list of directors' nominees for the offices falling vacant, with the following result:

For president, John J. Carty, New York; for vice-presidents, Comfort A. Adams, Cambridge, Mass.; J. Franklin Stevens, Philadelphia, Pa., and William McClellan, New York; for managers, John B. Taylor, Schenectady, N. Y.; C. E. Skinner, Pittsburgh, Pa.; F. B. Jewett, New York; Harold Pender, Philadelphia, Pa.; for treasurer, George A. Hamilton, Elizabeth, N. J.

Electrical Development and Jovian League.

Co-operation was the subject of the meeting on March 17th from the time that Stanley V. Walton, chairman of the day, started the ball rolling, until John A. Britton, the chief speaker, finished his address. Mr. Walton urged that the League members work together more closely, and as a definite object for such work A. H. Halloran moved that a Public Policy Committee be appointed to bring about better relations between the public and the public service corporation, each league member meanwhile constituting himself a committee of one to work for better public relations. The motion was seconded by T. E. Bibbins and carried unanimously. Subsequently, the question was discussed by Messrs. Whaley, Butte, Hillis, Baum and Goodwin. "Co-operation Between Central Station and Manufacturers" was the subject of a masterly address by Mr. Britton, vice-president and general manager of the Pacific Gas & Electric Company. In his belief the time is rapidly coming when the central stations will cease the direct sale of appliances, though they will continue to work for this kind of load, which in a few years has helped raise the load factor of the Pacific Gas & Electric Company from 12 to 74 per cent. Manufacturers and central stations should work hand in hand to reach the mass of consumers.

Los Angeles Jovian League.

St. Patrick's Day was accorded due recognition at the meeting on March 17th, when Ray W. Murphy, as chairman of the day, provided green decorations and Irish entertainment. F. M. Snispaugh gave a three minute talk on I. R. Solomon and Max Loewenthal, following a eulogy on the splendid results attained by James N. Colkitt, president during 1913-14, presented Mr. Colkitt with an appropriately engrossed morocco covered album, containing hundreds of clippings relating to his administration, taken from the Journal of Electricity, Power & Gas and The Jovian. Mr. Colkitt, after the applause had subsided, with his usual modesty, briefly responded with a few words of appreciation. The speaker of the day was J. M. Elliott, president of the First National Bank.

In speaking of the opportunities now open he related the incident of an American vessel, driven off its course by a storm, and running out of fresh water, finally coming within speaking distance of a vessel whose crew was of another nationality and unable to understand the plea of the Americans for a supply of water. Finally the American captain threw overboard a bucket, brought up some water and went through the motions of drinking. The captain of the other vessel also threw overboard a bucket, and after drawing it up proceeded to actually drink the water. "This action," said Mr. Elliott, "told the Americans that they were within the mouth of the Amazon River, with fresh water all around them, and that all they had to do was to dip it up. Opportunities are all around you here, and all you have to do is to dip them up."

NEWS OF CALIFORNIA RAILROAD COMMISSION.

The commission has authorized the Lassen Electric Company, operating in the town of Susanville and vicinity, to issue notes in the sum of $9500, payable to the Bank of Lassen and bearing interest at not to exceed 7 per cent per annum. These notes are to be used in refunding other notes outstanding.

The commission has authorized the Klamath Telephone & Telegraph Company to sell its lines in Siskiyou county to Joseph Hessig, J. H. Hessig and Augusta Hessig, for the sum of $15,000 or the surrender of an equivalent amount of the company's stock. This company operates between Dorris and Ager, and between Yreka and Happy Camp.

The commission has issued an order authorizing the Pacific Electric Railway Company to sell its heating and lighting system at Playa del Rey to the Southern California Edison Company for the sum of $1544.15.

The commisson has issued an order authorizing the Pacific Telephone & Telegraph Company to acquire the telephone system of the Weed Lumber Company, at Weed, Shasta county. The company was also authorized to make certain changes in the tariffs, which will remove the present discrimination.

The commission has authorized the Western Union Telegraph Company to sell its line between Sonora and Columbia, Tuolumne County, to Thomas Conlin, for the sum of $1. The distance between the two towns is approximately three miles.

The commission has rendered a decision authorizing the Oro Electric Corporation, operating in Butte and Tehama

counties, to pledge $180,000 face value of its bonds as collateral security for an issue of $60,000 of notes. These notes are to be dated March 25, 1915, and are to mature serially within a period of one year after date.

The commission has rendered a decision authorizing the Mt. Whitney Power & Electric Company to issue $238,000 of its 6 per cent bonds at not less than 95.

NO PUBLIC UTILITY COMMISSION FOR UTAH.

The Utah state senate killed Senator Evans' bill providing for the creation of a public utilities commission for the state of Utah, after the advocates and opponents of the measure thoroughly discussed it on the senate floor. The opponents in the measure were taking the position that no condition existed in the state which made such a commission necessary.

NEWS OF IDAHO PUBLIC UTILITY COMMISSION.

A petition has been filed with the public utilities commission by the Idaho Power & Light Company asking for a certificate of convenience and necessity in Canyon and Washington counties, particularly in the towns of Payette, Emmett, Parma and New Plymouth. This field is now served by the Idaho-Oregon Power & Light Company.

MUNICIPAL ENGINEERING.

Volume III of the transactions of the International Engineering Congress will comprise an important series of papers on the general subject of Municipal Engineering. The broad field will be treated under 9 topics covering the general subjects of city planning, streets, drainage, disposal of waste, water supply, protection against fire, transportation, public utilities and rural highways.

Approximately twenty papers are expected for this volume, prepared by authors representing six different countries. Of these papers, two may be mentioned by reason of their length and of the exhaustive character of the treatment. These are as follows: City Planning by Nelson P. Lewis; Traffic of London by Sir Albert Stanley.

The volume as a whole will be profusely illustrated with charts, diagrams and half tones, together with discussions contributed by leading American and foreign engineers, and will form a most valuable acquisition to the library of all engineers and others who may be interested in this phase of engineering work.

The transactions of the congress as a whole will include from seven to nine other volumes, covering the various fields of engineering work.

BOOKS RECEIVED.

"Successful Selling," by E. Leichter. 78 pp., 4½x7 in. Published by Funk & Wagnalls Co., New York, and for sale by Technical Book Shop. Price, 50 cents.

This is a short, practical and intensely interesting account of the essentials of selling efficiency. The problem is analyzed from a different standpoint than that usually taken in the correspondence course on selling, and the book should prove an inspiration, incentive and guide to old as well as new salesmen.

"Geometrical Reference Chart," by E. W. Liljegran, Medford, Ore.; 12 in. square. For sale by author or by Technical Book Shop, San Francisco. Price $1.00.

This four-color chart of angles and circles is intended as a handy reference for checking and in rough survey work with pocket transit or compass. It consists essentially of a series of concentric quarter circles superimposed on cross-section paper with radii denoting the angles from 0 to 90 degrees. The divisions are 1-10 in., so that approximate answers can be quickly obtained for any problem involving right angled triangles. A township plat is also included, making it convenient for surveyors and timber cruisers.

"Steam Charts," by F. O. Ellenwood; 91 pp.; 7x9½ in. Published by John Wiley & Sons, Inc., New York, and for sale by Technical Book Shop, San Francisco. Price $1.00.

There has long been a need for a convenient graphical representation of the data hidden away in the steam tables. This need is admirably met by this volume, which consists essentially of 15 charts with explanatory text and problems. Every steam engineer, whether engaged in design, testing or operation of steam power plant apparatus will find these charts of great assistance. From them it is possible to rapidly and accurately determine volume, entropy, intrinsic heat, temperature and heat of the liquid for any quality or superheat met in practice. The author has performed a great service for the engineering fraternity in thus interpreting what is ordinarily regarded as a difficult subject. The volume also includes a table of theoretical jet velocities and corrections of mercury columns. It is invaluable to all students of thermodynamics.

"Wiring of Finished Buildings," by Terrell Croft. 275 pp., 6x9. Published by the McGraw-Hill Book Co., New York City, and for sale by Technical Book Shop, San Francisco. Price, $2.00.

It is a pleasure to read a book in which the author has told what he knows about a subject in such a manner that others can utilize the information. The author of this text is a recognized authority on the subject, and he possesses an unusual knack in imparting his information. After definite statements and proof of the market for wiring new houses he takes up ways and means of getting such business by advertising and soliciting, as well as other questions of a commercial nature. In the technical section he discusses methods of wiring, planning installations, tools and manipulation, examples of installation and fixtures. The book is written from the standpoint of the East, where there is much more prospective business of this character than in the West because of the smaller proportion of unwired houses in this territory. Some of the suggestions for securing outlet boxes and running flexible conduit do not seem as substantial or simple as the methods in vogue on the Pacific Coast. But aside from advocating the use of the house cat for fishing wires under floors, the author has collected a great amount of valuable and reliable information. The book is well illustrated, and well worth the reading and the price.

"Telegraph Engineering," by Erich Hausmann; 406 pp.; 6x9 in.; 192 illustrations; cloth. Published by D. Van Nostrand Company, New York City, and for sale by Technical Book Shop, San Francisco. Price $3.00.

The average person little realizes the advance that has been made in telegraphy within the past few years. To such this book will be an eye-opener. Starting with a simple discussion of simplex telegraphy, by easy explanation the reader is brought to the subjects of duplex and multiplex telegraphy and automatic and printing telegraphy, all details of construction and operation being shown. Miscellaneous forms of telegraph, the telautograph, television and military induction telegraphs are also illustrated and described. Fire alarm and police patrol systems and railway signal systems are also treated in detail, as is likewise the general theory of current propagation in line conductors and submarine telegraphy. All these diversified subjects are co-ordinated and put into convenient form for reference and study. Practical problems are appended to each chapter to assist the student.

TRADE NOTES.

The Western Electric Company has just placed on the market a printing telegraph system. By this system a message, written upon a modified form of typewriter at one end of a telegraph line, is automatically printed, ready for delivery, at the other. Furthermore, not only one, but eight

messages may be sent simultaneously over a single wire, each message being printed as fast as the sending operator can typewrite it. A trial installation of this system, made by the Western Union Company, has been operating between New York and Boston for the past year and a half, and has been working practically day and night, frequently at a total speed of 360 words a minute.

The Manati Sugar Company, in the Province of Oriente, Cuba, with offices in New York City, has recently placed an order with the Westinghouse Electric & Manufacturing Company, East Pittsburg for electric motors to drive all of its machinery in its new mill with the exception of the engine-driven rolls. This order covers a total of thirty-two alternating current motors, having a total capacity of 1042 horsepower. All of the auxiliaries in this next extension of the Manati Sugar Company will be motor driven, these auxiliaries including cane and bagasse conveyors, centrifugal pumps, crystalizers, agitators, etc. All of the new material will be in operation for the 1915-1916 grinding and the electrical equipment will be delivered in time for this operation.

An interesting example of water power conservation is exhibited in the plant of the Granby Consolidated Mining, Smelting & Power Company, on Granby Bay, along the coast of British Columbia. The power plant is situated at tide level, the floor being only 20 feet above high tide. The water for driving more than 6000 h.p. of Pelton-Doble wheels, is taken from Falls Creek, a small stream flowing through a heavily timbered canyon opening into Granby Bay. A mile and a quarter from the stream mouth, a rock and timber dam is built across Falls Creek. Twenty feet below the crest of the dam, a short tunnel is driven through a rock ledge which forms part of the dam foundation. A wood stave pipe runs through this tunnel, thence following the contours and on the hydraulic gradient to a point on the canyon wall back of the power house. Here it connects to a riveted steel pipe line, which carries the water to the manifolds outside the power house foundation wall. Ten Pelton-Doble tangential wheels, ranging in size from 3 feet to 24 feet in diameter, drive air compressors and blow engines for mine and smelter operation and the hydroelectric plant for supplying electric energy to all parts of the workings. This plant is one of the notable installations of 1914.

The Baker-Joslyn Company has been incorporated and on April 1, 1915, will open offices and warehouse at 71 New Montgomery Street, San Francisco, as distributors of electrical material through the trade. This company has taken over the electrical lines of The Maydwell Company, San Francisco, who are withdrawing from the electrical field. The officers of the new company are: President, M. L. Joslyn; vice-president and treasurer, C. G. A. Baker; secretary, H. F. Hartzell. Mr. Joslyn is president of the Joslyn Manufacturing & Supply Company of Chicago, manufacturers and distributors of electrical material. Mr. Baker has been associated for many years with the Maydwell Company as vice-president and has been actively in charge of the electrical branches of their business. He will be in full management of the business operations of the Baker-Joslyn Company and brings to the new company his valuable experience in these lines. Mr. Hartzell has been on the sales force of the Maydwell Company for the past two years, and will occupy the same position in the sales department of the new company that he formerly held in the Maydwell Company. The Baker-Joslyn Company contemplates considerable expansion in the electrical field and a policy of co-operation with the electrical trade of the coast, representing not only the prominent Eastern manufacturers of electrical material formerly represented by the Maydwell Company, but several new large manufacturers as well. The lines will cover practically the entire field of pole line material, electrical railway, light, power, telephone and construction material. Branches will also be maintained at Seattle and Los Angeles.

PUBLICATIONS RECEIVED.

Circular No. 52 from the U. S. Bureau of Standards, "Regulation of Electrotyping Solutions," suggests standards of density and acidity for obtaining the best results for copper and nickel deposition.

Scientific Paper No. 231 from the U. S. Bureau of Standards on the Specific Heat of Copper gives a critical review of previous experiments and presents the results of an exhaustive investigation by D. R. Harper.

The supplement to the General Electric Review for March, 1915, is a handsome reproduction in colors of the illuminated resolutions presented to Mr. Charles A. Coffin and Mr. E. Wilbur Rice Jr. by the Association of Edison Illuminating Companies on the occasion of Mr. Coffin's relinquishing and Mr. Rice's assuming the duties of president of the General Electric Company. Each is a work of art and demonstrates the wonderful effects that may be produced by modern color printing.

NEW CATALOGUES.

D. & W. Fuse Co. have issued an attractive booklet about reasons why "D. & W." fuses are specified.

Terry Turbines for Pump Drive is the subject of Bulletin 19 from The Terry Steam Turbine Company of Hartford, Conn. Impartial presentation is given of the advantages and limitations of turbine driven centrifugal pumps.

"The Edison Business Builder" for March, 1915, from the Edison Lamp Works of General Electric Company, is a house wiring number. It contains detailed information about house wiring campaigns of value to every central station and electrical contractor.

"Pole Line Hardware" is the title of Catalogue Section DS 846, issued by the Westinghouse Electric & Manufacturing Company. This catalogue gives a complete list of the different accessories used in connection with transmission lines, together with illustrations of same.

Sprague Electric Works of General Electric Company, are distributing a descriptive leaflet about "Greenfielduct, The Pipe of Quality." Details of its manufacture are given, together with prices and notable installations. Booklets regarding the Sprague electric fans for 1915 are also now available.

Berkeley Electric Cooker Company, manufacturers of the "Good Housekeeping Cooker," at Berkeley, Cal., are distributing a handsome and convincing booklet regarding the merits of their cooker, the latest type of which consists of two disc stoves in addition to the automatic cooking device.

Wheel Lathe Equipments are described and illustrated in Leaflet No. 3482-A, just issued by the Westinghouse Electric & Manufacturing Company. The class of work performed by these equipments is of special nature, owing to the fact that hard spots are frequently encountered, and unless cut at low speeds the tool is apt to break. Such conditions call for an efficient control system, which is supplied in these equipments.

"Some Electrical Problems Practically Considered" is the title of a paper presented before the recent convention of iron and steel electrical engineers held in Cleveland, by Mr. B. G. Lamme, chief engineer of the Westinghouse Electric & Manufacturing Company, and has been issued in pamphlet form by this company. The particular subjects covered are insulation, commutation, including its theory, speed control, and choice of frequency.

The General Electric Company has just issued an attractive bulletin on Small Turbo-Generator Sets, 7 kw. to 300 kw. The number of the bulletin is 42010. In Bulletin 42300 is described that company's line of small direct connected generating sets of sizes ranging from 2½ kw. to 75 kw. Bulletin No. 45602 deals with the subject of the protection of series lighting circuits by lightning arresters. Illustrations and dimension diagrams on horn and aluminum type arresters are included in the bulletin.

INDUSTRIAL

MINERS' ELECTRIC LAMP.

The General Electric Company is offering a new miners' electric lamp that is entirely safe to use, of very strong construction yet light in weight, simple in design, foolproof, very efficient in operation and of ample guaranteed capacity. The outfit consists essentially of a lead plate battery, carried on the belt; a ¾ c.p. Mazda lamp with a suitable reflector held in a steel shell, carried on the cap; and a strong, serviceable cable connecting the battery and the lamp.

The outfit complete weighs but 3¾ lb. of which 3½ lb. are carried on the belt and 4 oz. on the cap. The battery is rated at 7.2 amp.-hr. Normally it will light the lamp 12

General Electric Company's Miners' Electric Lamp.

hr. per charge and can be relied on to furnish light at least 20¾ hr. per charge at the end of one year's service. The ¾ c.p. Mazda lamp operates at 1.9 volts and the reflector distributes the light evenly through a solid angle of about 130 deg.

The battery is non-spilling and the terminals are not subject to said corrosion. The case is of medium hard rubber. Exide plates are used. The battery box measures 6¼ in. high by 5 in. wide by 2 in. thick overall. It is made of drawn sheet steel, electrically welded, including the two side straps for the miner's belt.

SUBWAY TYPE OIL FOR FUSE CUTOUTS FOR HIGH TENSION WORK.

The success that has been experienced in service with "D. & W." pole type oil fuse cutouts, together with the increasing demand for a thoroughly reliable, high-grade protective device for subway service, has warranted the D. & W. Fuse Company designing a primary oil fuse cutout for this work.

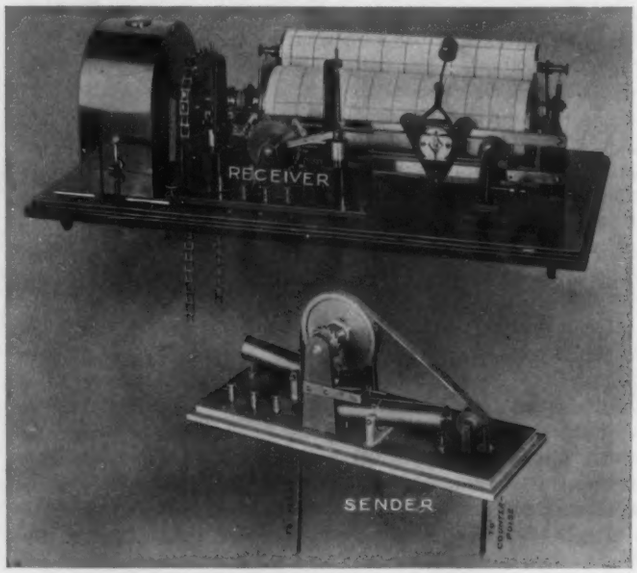
In the essential principles these cutouts are identical with their pole type. Some modifications have necessarily been made to adapt them for the different class of service in which they are to be used. These include the substitution of a lead gasket for the compressible gasket employed in the pole type cutout, different provision for venting the cutout and protecting it against the possibility of water entering through the vent openings, and a radically new method of arranging for connection with the cables in the two and three pole types. These cutouts are made in 50, 100 and 200 ampere capacities, single pole, and in 50 and 100 ampere capacities, double and triple pole, 2500 volts.

In the "D. & W." cutout, the fusible element is placed under a heavy body of special oil. On the blowing of the fuse the terminals are so arranged that they are forcibly thrown apart, and the oil being interposed between them, effectually prevents the formation of an arc.

A large number of these cutouts are said to be giving entire satisfaction, due to the effectiveness of their operation and to the fact that they give to the lineman a maximum amount of protection, inasmuch as it is perfectly safe for him to insert a new fuse even when the line is short circuited without risk to himself, as the whole device is effectually locked against the blowing out of the carrier and the oil in case of the unexpected blowing of a fuse during renewal.

A NOVEL WATER STAGE RECORDER.

A novel series of instruments for graphically recording fluctuations in water levels has recently been perfected by J. C. Stevens, consulting hydraulic engineer at Portland, Ore. The instrument consists essentially of a clock which actuates and regulates the movement of a roll of cross section paper upon which a pencil records the movements of a float placed in the water. Several types of instruments have been devised so that it is possible to get an automatic record of stream flow conditions in inaccessible places, over a long period of time as well as shorter records where sudden fluctuations are found.



Stevens Long Distance Water Stage Recorder.

Many refinements have also been added so that it is possible to get one or more long distance records by electrical methods. Another type of differential water storage recorder gives the net difference of water levels, so that it is thus possible to record the net head of water operating on water wheels.

TRADE NOTE

The Hotpoint Electric Heating Company, Ontario, Cal., has set aside the week of May 3-8 to push its new "El Grilstovo," and will designate the period as "Hotpoint week." The company is sending samples of the stove to dealers, and during the above week the device will be sold at a special discount. For five years the Hotpoint company has inaugurated such a special selling campaign, although prior to last year only one day was set aside for the purpose.

NEWS NOTES

FINANCIAL.

YERBA LINDA, CAL.—The directors of the Yerba Linda Water Company have authorized a bonded indebtedness of $150,000 to liquidate present obligations and to install about $100,000 worth of new pipe lines and pumping machinery. The bonds will be ready for market as soon as the necessary legal steps can be taken.

GLENDALE, CAL.—The city trustees have granted the request of the William R. Staats Company for an extension of 30 days from March 3 of its option to purchase the remainder of the city's water bonds, offering to take in addition to the $75,000 worth now purchased, $12,000 worth out of the $59,000, putting the first purchase at $87,000, with extension on the remaining $47,000.

INCORPORATIONS.

PAROWAN, UTAH.—Articles of incorporation have been filed for the Iron County Electric Light Company, whose purpose is the installation of an electric light plant at this place. No bonds will be issued. Mr. T. J. Yates, an engineer of Salt Lake, assisted by James Ollerton of this place, has had the matter in hand.

ANACONDA, MONT.—Articles of incorporation have been filed for the Little Missouri Improvement & Development Company, with Frank K. Wilson, Thomas T. Lyon and A. L. Rankin, as directors. The capital stock is $150,000. The object is to construct and operate electric light and power plants, telephone lines, water works, etc.

HUNTINGTON, UTAH.—A company has been formed here for the purpose of installing an electric light and power plant. It will do business under the name of the Huntington Electric Light & Telephone Company. The officers are: Mart Jensen, president; L. N. Strong, vice-president; Byron Howard, secretary. The location of the proposed power plant has already been determined, and construction work will start at an early date.

ILLUMINATION.

SUSANVILLE, CAL.—H. Howard Dunbar has been granted a gas franchise in this city.

ORANGE, CAL.—An election will be held April 10th, for the purpose of voting upon the formation of the "El Modena Lighting District."

PARLIER, CAL.—Sealed bids will be received by the supervisors of Fresno county until May 4th, for a franchise to lay gas pipes in this town.

LOS ANGELES, CAL.—The city council has referred a request asking for an appropriation for electric lights in Chesterfield Square, to the budget committee.

ANAHEIM, CAL.—The board of trade has appointed a committee to take up the matter of purchasing electric current from the Southern California Edison Company.

WALES, UTAH.—The Big Springs Electric Company of Fountain Green has petitioned the town board for a franchise for the installation of an electric light system here.

PASADENA, CAL.—The city commission has awarded the contract for the installation of electric lights on Bellefontaine street, to the Southern California Electric Company.

LOS ANGELES, CAL.—The board of supervisors has awarded the contract for lighting the streets in the Norwalk Lighting District to the Southern California Edison Company.

LOS ANGELES, CAL.—Bonds in the sum of $7000 have been voted for a lighting system on Main street from Ninety-second street to Athens-on-the-Hill. A committee has been appointed to handle the improvement.

BROWNSVILLE, ORE.—The council has authorized the mayor to enter into a 5 year contract with the Oregon Power Company for lighting the streets of the city with incandescent lighting system.

FLORENCE, ARIZ.—The question of lights and a water supply has come up again and is receiving favorable attention. A number of prominent citizens have expressed themselves in favor of improvement.

OAKLAND, CAL.—The request of property owners on Telegraph avenue between Twenty-second and Forty-fifth streets, has been granted for the construction of electroliers, the contract to be given to the Joshua Hendy Iron Works.

SAN FRANCISCO, CAL.—Plans have been prepared for an eight story and basement Class A office building to cost $150,000 on Sutter stret, near Powell, for the Pacific Gas & Electric Company, by Architect Edgar A. Mathews.

EL PASO, TEXAS.—In lighting San Francisco street, it has been found necessary to have a direct system installed and special machinery has been ordered for this. It is planned to light the streets for the first time about April 1st.

SAN BERNARDINO, CAL.—The board of supervisors has called for bids for furnishing of lights to the Highland Lighting District, which will be opened April 6th. Lights have been ordered on Olive street, between Pacific avenue and Base line.

BATTLE MOUNTAIN, NEV.—A building is being erected here by H. P. Lemaire, H. C. Christensen and St. Clair Moore, which is to house an electric plant both for lighting and power purposes. The plant will also furnish power to ranches for pumping water for irrigation.

GLENDIVE, MONT.—A franchise was granted to M. W. Milligan and associates of Miles City for the establishment of a gas plant in Glendive. The franchise will continue for five years and the work of laying mains and getting the system in operation must be completed within three years.

SEATTLE, WASH.—The utilities committee of the council recommended a bill for passage appropriating $25,000 from the steam plant bond issue for the installation of an additional boiler at the Lake Union steam plant, completing its capacity to a maximum of 10,000 kilowatt hours.

SACRAMENTO, CAL.—In the future the city will advertise for bids and secure competition for electric lamps and other form of lamps used by the various departments. At the suggestion of Commissioner Thomas Coulter, the commission has authorized bids. The city uses annually nearly 6000 lamps.

LOS ANGELES, CAL.—The board of supervisors will receive sealed bids up to April 19, for a franchise to lay down and maintain for a period of forty years, a system of gas pipes in all public highways in township 3 south, range 11 west, and certain others, excepting as designated as lying in the incorporate city of Whittier.

ELLENSBURG, WASH.—Plans for the $60,000 auxiliary power and light plant for this city have been completed and submitted to the city council and the city clerk has been instructed to make a call for bids at once. The building will be fireproof according to plans of City Engineer Carter and will be provided with a new steam auxiliary turbine capable of handling the entire power and light load demanded of the city system.

SALT LAKE CITY, UTAH.—The authorities of the Mormon Church have let a contract for the installation of a lighting system about the celebrated wall which surrounds the block in Salt Lake City and encloses the famous Tabernacle and Temple; 750 watt Type "C" Mazda lamps will be installed

every 50 feet along the wall. The wall is built of solid masonry and is approximately 12 feet high. It has a course of native sandstone around the top of it

SALT LAKE CITY, UTAH.—The Utah Power & Light Company has announced a reduction in its rate for electricity used for cooking purposes from 4c per kilowatt hour to 3c per kilowatt hour subject to the usual 10 per cent discount for prompt payment. The company announces that it has received a large consignment of electric ranges in various sizes and makes in anticipation of a heavy demand for electric cooking throughout the territory which it serves.

PARK CITY, UTAH.—The Heber Light & Power Company has made a proposition to this city to sell it a one-half interest in the Heber company's plant which it claimed would be ample to furnish light and power for a city three times the size of Park City. Mayor Tallon and Councilman Ivory were appointed a committee to investigate the proposition and report. The plan proposed is to construct a steel tower transmission line from Heber City to this city and there to install a distribution system for the supplying of eletcricity for lighting and power purposes to the residents.

SALT LAKE CITY, UTAH.—The Utah State Legislature passed Senator Cottrell's bill providing for the creation of special lighting improvement districts. The purpose of this bill is to enable the business men of Salt Lake City to install special Whiteway lighting and assess the cost of installation and operation of the same against the property benefitted. Mr. W. D'A. Ryan, illuminating engineer for the General Electric Company, was in Salt Lake City on March 8th and 9th for the purpose of consulting with the upper Main Street Association and State Street Association relative to the most desirable kind of special street lighting adaptable to Salt Lake City. Mr. Ryan advised the property owners that owing to their usually wide streets, an opportunity is presented to install a system of street lighting quite different from anything now in use. In general he outlined a plan of massed lights, either 3 or 5 lamps to the pole, the poles to be placed approximately 125 feet apart. The distance from the curb to the center of the mass to be 30 to 35 feet. Final plans covering the installation of such a system will be presented to the property owners within the next couple of weeks.

TELEPHONE AND TELEGRAPH.

WATTS, CAL.—The Los Angeles Sunset telephone company has been investigating properties in this city for the location of a substation.

DUNCAN, ARIZ.—Poles are now being set for a telephone line between Duncan and Lordsburg. It is expected that the line will be in operation in April.

EUGENE, ORE.—E. J. Horton, S. M. Horton and J. C. Horton have a franchise for telephone lines along the country roads from Lake Creek to Junction City.

HARRINGTON, WASH.—The council passed ordinance granting the Farm & City Telephone Company, Davenport, a franchise for 10 years into Harrington.

RICHFIELD, IDAHO.—The farmers in this vicinity are preparing to construct a co-operative telephone system to be connected with a telephone exchange here.

WAITSBURG, WASH.—An ordinance has been adopted by the council granting to the Waitsburg Rural Telephone Company a franchise to operate on streets and alleys of the city.

SPOKANE, WASH.—A franchise has been granted to the Bronx Farmers' Telephone Company to erect and operate a telephone along the county road between Colburn and Ponderay.

NORTH YAKIMA, WASH.—A. M. Hurfin, business manager Yakima Valley Telephone Company, is asking the commissioners for a franchise for 30 years for lines of the company.

NEW WESTMINSTER, B. C.—The B. C. Telephone Company has been granted permission by the Matsqui council to use the north side of Page road for a long distance line between Vancouver and Upper county.

WILCOX, ARIZ.—J. Frank Wootan, H. T. and Charles Firth, Drew Wilson and Thos. Allaire of Klondyke are circulating a petition and securing funds for a telephone connection between Aravaipa and Bonita.

SANDPOINT, IDAHO.—A franchise has been granted by the county commissioners to the Bronx Farmers' Telephone Company to operate and erect a telephone line along the county road between Colburn and Ponderay.

COLVILLE, WASH.—The franchise granted by the board of county commissioners to the Colville & Meyers Telephone Company and the Eco Valley & Colville Telephone Company, to use public highways to extend lines into rural districts.

TWIN FALLS, IDAHO.—Manager Green, Mountain States Telephone and Telegraph Company, states the company will soon begin the construction of a modern brick telephone building on Shoshone street.

BROWNSVILLE, ORE.—The directors of the Pioneer Mutual Telephone Company have voted to rebuild the company's line between Brownsville and Linn and to rebuild the line from Walnut avenue to Coshow avenue in the city. Work is to start at once.

LOS ANGELES, CAL.—A $200,000 government contract for the erection of the San Diego and Honolulu radio towers has been awarded to the Llewellyn Iron Works of this city. The company has eleven months in which to complete these towers, which will be 600 ft. tall.

ALBUQUERQUE, N. M.—W. T. Chenault, head lineman for this district of the Mountain States Telephone Company, is supervising a general overhauling and rebuilding of the local exchange. The city lines are being rebuilt and a new $3000 switchboard will be installed.

RIVERSIDE, CAL.—The city council has rejected the proposition for a joint telephone system of the Home and Pacific Telephone & Telegraph Companies, for which the franchise had been drawn up. The Pacific Telephone franchise has now expired, and the company is operating without one.

GONZALES, CAL.—The Gonzales Rural Telephone Company has been organized with S. O. Pugh as president, John C. Bazier, secretary, and Paul Bianchi, Louis Rianda and Henry Pugh, directors. The lines of the company will extend from Ganzales across the river and from Soberanes school house to Malarin's on the north.

SPOKANE, WASH.—Permission to foreclose on the entire plant of the Inland Independent Telephone Company, together with its franchise from Waverly, Oakesdale, Palouse, Garfield and Spokane county and Whitman county, is asked in a suit filed against the company by the Coeur d'Alene Bank and Trust Company to recover on trust deeds for $57,500.

SAN FRANCISCO, CAL.—At the annual meeting of the stockholders of the Philippine Telephone & Telegraph Company, the outgoing board of directors, comprising Louis Glass, S. Waldo Coleman, Chas. J. Deering, A. B. Cooper and F. W. Eaton, was re-elected. At a subsequent meeting the outgoing officers, headed by Louis Glass, the president were also re-elected.

LOS ANGELES, CAL.—The suit begun in 1911 by the Home Telephone Company against the City of Los Angeles to compel a refund of $600 paid as a license tax, has been decided by Superior Judge York in favor of the company. The telephone company contended that the ordinance was unconstitutional, and that the tax was paid under duress. The city admitted the unconstitutionality of the ordinance, but asserted that the payment of the tax was voluntary.